ELECTRICAL REVIEW

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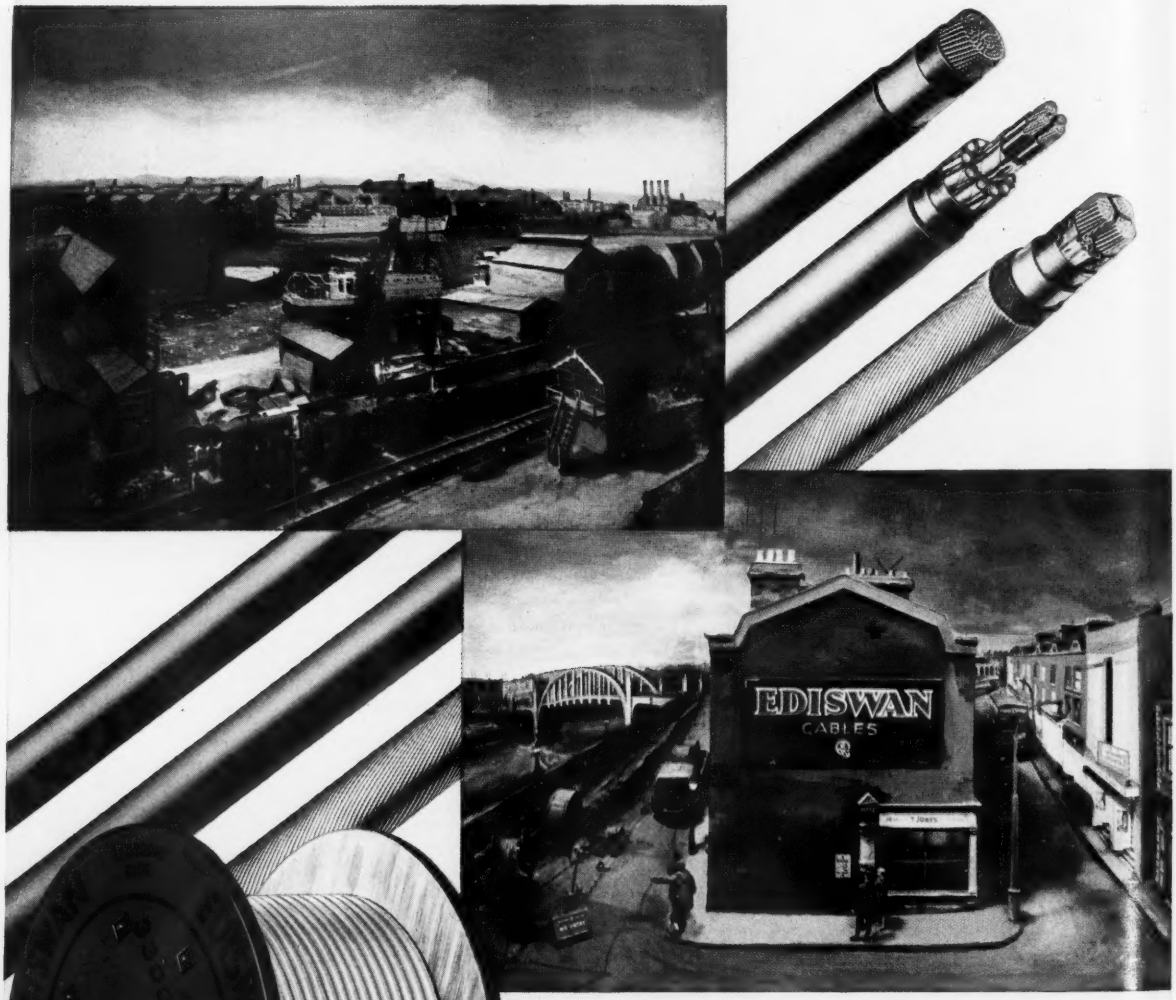

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ELECTRICAL REVIEW

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21 DECEMBER 1956

In This Issue

1125 NUCLEAR POWER PROGRAMME BEGINS
1127 POWER FOR INDUSTRY
1129 ELECTRONIC CONTROL OF INDUSTRIAL PROCESSES
1130 BEYOND THE MOTOR COUPLING
1135 ELECTRICITY BILL OMISSIONS
1137 VIEWS ON THE NEWS
1138 PERSONAL AND SOCIAL
1143 INDUSTRIAL NEWS
1147 LETTERS TO THE EDITOR
1148 NUCLEAR POWER STATIONS
1152 EUROPEAN CO-OPERATION
1153 AUSTRIA'S ELECTRICAL TRADE
1155 POWER SUPPLY IN SOUTH AFRICA
1156 FUEL AND POWER IN THE UNITED KINGDOM
1157 V.H.F. SOUND BROADCASTING
1158 GENERATION AND DEVELOPMENT
1159 NEW LIGHTING IN ROTHERHITHE TUNNEL
1160 NEW ELECTRICAL EQUIPMENT
1162 FINANCIAL SECTION
1164 NEW PATENTS
1165 CONTRACT INFORMATION

95 *CLASSIFIED ADVERTISEMENTS*
104 *INDEX TO ADVERTISERS*

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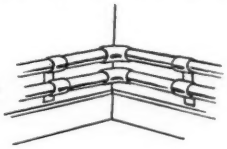
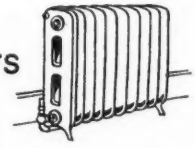
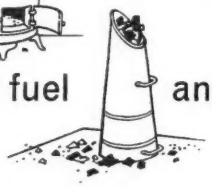
of a boiler and pipes  and radiators 

and dirty fuel  and dusty ashes when all they

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ELECTRICAL REVIEW

21 December 1956 Vol. 159 No. 25 Established 1872

Nuclear Power Programme Begins

ORDERS for something approaching 1,000 MW of power plant, costing over £100 million, were placed last week by the Central Electricity Authority and the South of Scotland Electricity Board. Because of the magnitude of the contracts and the fact that the three stations to be erected will derive their heat from nuclear fission, the occasion is historic as marking the committal of the national electricity supply authority to this form of power generation.

It is something of an act of faith that the large programme foreshadowed in the White Paper on atomic energy has been embarked upon while Calder Hall, the inauguration of which was a historic prelude, has been in operation for so short a time. We suppose that operational experience at Calder Hall will influence, at least in some details, the final shape of the larger stations which, of course, are designed for power production and not, like Calder Hall, primarily for producing plutonium.

In the White Paper, stations rated (rather vaguely) at from 100 to 200 MW were envisaged. The three stations now announced will have capacities ranging from 275 to 320 MW (sent out). Capital cost per kW is stated by the C.E.A. to be from two-and-a-half to three times that of a coal-fired station, which may amount to between £100 and £140. This higher cost (amortised over twenty years) will of course be reflected, in the form of capital charges, in the " unit " cost.

What the cost of production will be is not ascertainable within close limits. The White Paper, in a somewhat tentative way, mentioned a cost of 0·6d/kWh. The C.E.A. is extremely cautious about cost and other important details, but for the South of Scotland station the more conservative figure of under 0·7d/kWh (based on an annual load factor of 80 per cent) has been mentioned. The employment in the Scottish station of considerably higher steam pressures than in the Calder Hall prototype should be advantageous from the cost aspect, as should the higher pressure of the carbon-dioxide coolant.

An unknown factor is the cost of the uranium which has to be supplied by the United Kingdom Atomic Energy Authority and is not included in the contract price. One question is whether the " fuel " is to be bought or " leased " from the A.E.A. In the case of the two Scottish reactors the uranium charge is said to be 500 tons. Offset against this will be the value of the plutonium recovered from the reactors—another unknown quantity.

It is confidently hoped by the C.E.A. that with greater experience of construction and operation the cost per kW, and consequently per kWh, will be progressively reduced until nuclear electricity is competitive with power produced by coal or oil. This is of considerable importance in the securing of overseas contracts in which respect at the moment British constructors are favourably placed.

THE BILL AND THE COMMITTEE

As we have already recorded, the draft Electricity Bill differs from the Herbert Committee's proposals chiefly as regards the topmost portion of the supply industry's structure. Instead of an independent authority standing apart from, and above, both generating and distributing Boards, the Bill proposes a Council composed largely of Board chairmen for purposes of co-ordination and common action. This ensures that the Council will not have " power without responsibility " though it may find itself in the opposite dilemma of having responsibility without power. The plan certainly has dangers of its own, some of which are pointed out by Mr. D. J. Bolton in an article in this issue. The chief of these might concern the price of bulk supplies.

The bulk supply tariff is the economic link between the two main branches of electricity supply, generation and distribution. Small changes in its magnitude have power to wreck the finances of either branch, and in this respect the interests of the two branches are diametrically opposed since one is the buyer and the other is the seller. The absence of any over-riding authority in the industry will not make the solution any easier.

One question which the reorganisation opens up without attempting to solve is that of the sub-divisional organisation of generation. The number and the areas of the generation Divisions, and the powers of the divisional controllers will all require re-examination in the light of the new structure of the industry and the new methods of generation. Other unanswered questions concern the many recommendations in the Herbert Committee's Report which do not require legislation to put them into operation.

THE LIMIT ?

A review of the background of post-war development in generation has recently been issued by the Central Electricity Authority. It explains the adoption as standard of 30 MW and 60 MW turbo-alternator sets immediately after the war with a view to overcoming the generating plant shortage as early as possible, and gives a brief survey of the 1955-57 generating plant programmes which embrace sets with capacities of from 100 MW to 200 MW, with steam conditions rising to 2,350 lb/ sq in and 1,050 deg F, with reheat.

The statement goes on to show that increases in steam conditions above those so far adopted introduce technical problems the solution of which causes costs to rise very steeply. Having regard to this and to present understanding of the fouling and corrosion problems associated with British coals, it has been considered that advance beyond a steam temperature of 1,050 deg F would not be justifiable at the present time. The conclusion has therefore been reached that for the next step in development of units for general application there will be no profit in advancing the steam conditions and virtually all the economy must be sought from increased size, although development of designs for higher steam conditions will proceed with an eye to the future.

In orders recently placed for generating plant in the United States there has been a step back from 1,100 deg F to 1,050 deg F in operating temperature, and this looks rather as though conclusions similar to those of the Central Electricity Authority are being reached in America.

FRESH APPROACH

It is often the case that when one has been engaged in a particular industry for many years that one tends not to see the wood for the trees. This fact appears to have been borne in mind when the new Central Engineering Establishment of the National Coal Board was set up at Bretby in South Derbyshire. On the whole it might be true to say that the mining and mining equipment manufacturing industries are somewhat of a " closed shop " and so much inbreeding has been going on over the years that a certain amount of " staleness " is not unlikely.

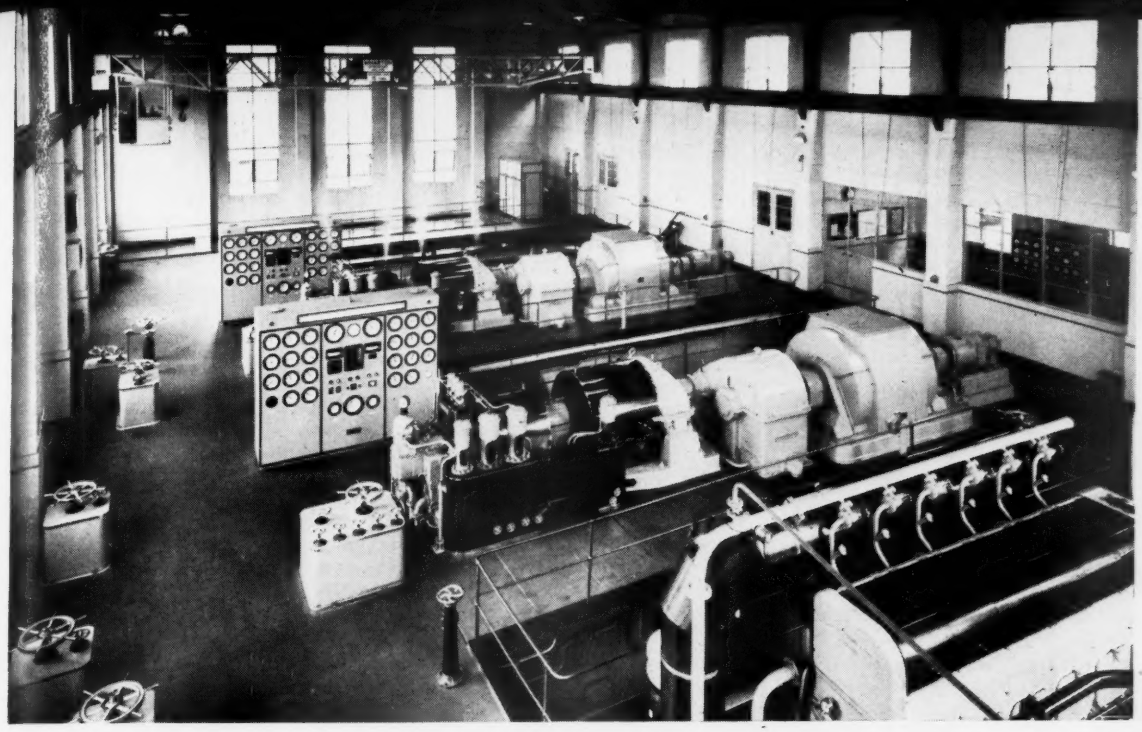
To avoid conservatism and conventional approaches to problems the senior staff of the new National Coal Board establishment has been carefully chosen. For instance, the director was previously concerned with the design and development of armoured fighting vehicles, while the senior engineers include a servo-mechanism expert and a man from the aircraft industry. This does not mean that there are no mining men in the establishment; this is far from being the case, but the introduction of the new blood should result in a completely fresh approach being made to many problems. We feel that this is a step in the right direction and that many useful contributions will be made towards increasing mining efficiency.

AN OLD SUBJECT

The annual report of the Chief Inspector of Factories for 1955, reviewed last week, states that there is a continued occurrence of accidents in " isolated " switchboards or cubicles due to electricians or semi-skilled men coming into contact with live conductors. The report mentions that this subject is as old as the industry and that it is again necessary to emphasise that so-called " isolated " switchboards or cubicles should not permit access to live conductors in the ordinary course of work.

We feel that it is worth while calling readers' attention to the above fact and also to the criticism directed against auxiliary switchgear of the " quart in a pint pot " type, where a saving in space and cost may be made but often at the expense of access for easy and efficient maintenance. Although it is sometimes necessary to pay high prices for substation sites, it is hoped that the facilities mentioned will not be sacrificed in order to cut the cost of major distribution substations.

We extend to all our readers our
Best Wishes for Christmas
and the Coming Year.



Electrical Review 21 December 1956

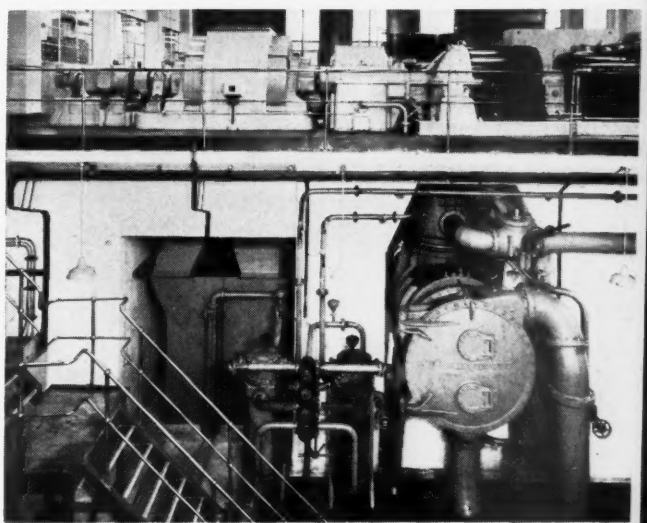
POWER FOR INDUSTRY

Avenue Carbonisation and Chemical Plant

THE recent official opening of the Avenue carbonisation and chemical plant at Wingerworth, near Chesterfield, by the Minister of Fuel and Power, marked the completion of the first stage of the largest single contract so far placed by the National Coal Board and the beginning of full-scale operation of the Board's most up-to-date coal carbonising plant. The complete installation covers an area of about 190 acres in the East Midlands Division of the National Coal Board, and has been constructed for the production of smokeless fuel from the lower grade coals which are mined nearby. The main contractors for the plant were the Woodall-Duckham Construction Co., Ltd.

Initially, the plant has been designed to carbonise about 750,000 tons of coal a year to produce 500,000 tons of coke for domestic purposes and 5,000 million cu ft of town gas. Apart from this the by-product plant will process annually six million gallons of crude benzole, 13½ million gallons of tar, 18,000 tons of sulphuric acid and 12,000 tons of sulphate of ammonia. The plant is fully integrated and is complete with its own breeze fired boilers for steam raising and a generating station to provide power throughout the works.

All the low-pressure steam requirements and most of the electric power for the site are supplied from this power station. To provide an economical arrangement, pass-out turbines are installed, which use steam at 450 lb/sq in and 625 deg F from the boiler house. Electrical power is generated as a by-product of the pass-out steam, which is required at 120-130 lb/sq in, at considerably less cost than it could be obtained from the public electricity supply or produced by straight condensing turbo sets. To achieve the maximum flexibility of the supply to suit varying steam and power demands, the turbines are provided with a condensing section which will produce any power required additional to that generated from the pass-out steam, and a reducing valve is fitted in parallel with the turbines in case the low-pressure steam demand



Above: General view of the turbine room showing two 5 MW Allen pass-out condensing steam turbines

Right: Condensing plant and auxiliaries with alternator air-cooler and ducting

is greater than that necessary to meet the electrical power demand at any given instant.

The two steam turbines have been supplied by W. H. Allen, Sons & Co., Ltd. Each is designed for a power output of 5 MW, and a pass-out steam quantity of 95,000 lb/hr with a condenser suitable for 40,000 lb/hr at 28in Hg vacuum, and permitting 3 MW to be generated with no pass-out flow. The machines are of the twin-cylinder, multi-stage, impulse, geared type, with the cylinders arranged in tandem and the pass-out branch at the end of the h.p. cylinder, the l.p. cylinder acting as the condensing end.

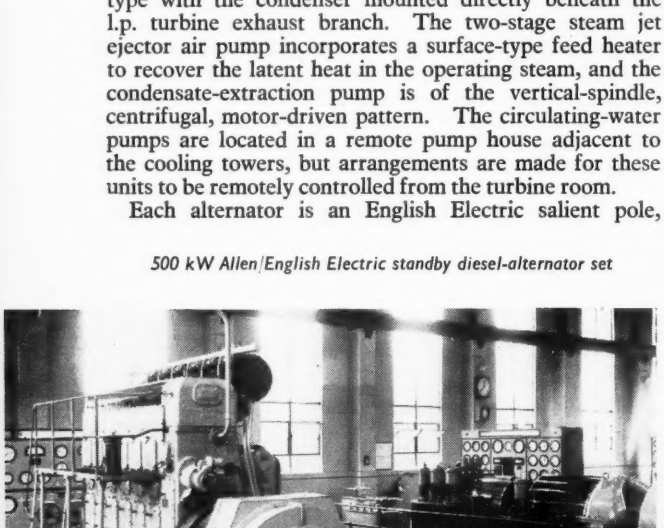
In addition to the leverless oil-relay type constant-speed governor, each turbine is fitted with pass-out governor gear designed to maintain a constant pressure at the pass-out branch, irrespective of changes of load or demands for low-pressure steam. A number of automatically-operated nozzle-control valves are provided to ensure maximum economy of steam at all loads and throttle flows, by maintaining the pressure upstream of the turbine nozzles at the highest possible figure, thus avoiding throttling. The speed of the turbine can be adjusted locally by hand or, alternatively, by a small motor controlled from the main switchboard.

The governor and lubricating-oil systems are so arranged that it is not possible to start the turbine until the bearings have been flooded with oil, and a lubricating-oil pressure trip cock is also incorporated to ensure that the machine is brought to rest immediately upon failure of oil pressure. The turbines run at a speed of 4,000 r.p.m., geared down to an alternator speed of 1,000 r.p.m., the gearing being of the double-helical, single-reduction, totally-enclosed, parallel-shaft type, forced lubricated from the turbine oil system.

The condensing plant is of the conventional basement type with the condenser mounted directly beneath the l.p. turbine exhaust branch. The two-stage steam jet ejector air pump incorporates a surface-type feed heater to recover the latent heat in the operating steam, and the condensate-extraction pump is of the vertical-spindle, centrifugal, motor-driven pattern. The circulating-water pumps are located in a remote pump house adjacent to the cooling towers, but arrangements are made for these units to be remotely controlled from the turbine room.

Each alternator is an English Electric salient pole, revolving-field machine, having a closed-air circuit with the air cooler arranged in the foundations below the machine. The windings are impregnated with chemical-fume-resisting compound. Each machine, which is provided with totally-enclosed main and pilot exciters, is wound for a 3·3 kV three-phase 50 c/s supply.

500 kW Allen/English Electric standby diesel-alternator set



Both the h.p. and l.p. steam-pipe systems are arranged in the form of a ring main and suitably valved so that in the event of an overhaul to either turbine or any section of pipe, an uninterrupted supply of power and steam can be maintained. Arrangements are made for collecting all the clean drain water and condenser flooding water in a " save-all " tank, from which it is pumped back to the hot well.

The reducing valve and its associated desuperheater are of Hagan design, manufactured by James Gordon & Co., and designed to have a maximum discharge into the low-pressure steam mains of 75,000 lb/hr. The valve is of the tight-shutting pattern, and desuperheating is effected by injecting the cooling water directly into the steam main which is provided locally with protective sleeves. This equipment is servo-motor operated by compressed air which is obtained from small motor-driven compressors. Also, to maintain a constant superheat of only 50 deg F in the low-pressure steam, a Hagan spray-nozzle desuperheater is fitted in both legs of the low-pressure steam main at the point where they leave the building.

A 500 kW diesel-alternator set is installed to provide power for the initial starting-up of the plant, and is arranged to start up automatically upon failure of the power supply from the turbo-alternator, the starting system being initiated by means of back contacts on each of the main turbo-alternator circuit-breakers.

The Allen six-cylinder, vertical, airless-injection, compression-ignition two-stroke diesel engine drives an English Electric alternator at a speed of 375 r.p.m., the alternator being similar to the turbine-driven units. As in the case of the turbines, the engine speed can be controlled locally or remotely by means of a small electric motor. The normal method of starting is by means of compressed air admitted to all cylinders at a pressure of 300 lb/sq in from air bottles which are maintained at full pressure by a small motor-driven air compressor. A standby petrol engine-driven compressor is installed for use should the normal electricity supply not be available for any reason. The diesel engine installation is completely self-contained, including a daily service fuel tank for 12 hours' supply at full load.

Electricity is distributed from the power station by three separate systems, 3·3 kV a.c., 415 V a.c., and 220 V d.c. The supply from the alternators is taken to a 17-panel high-voltage oil circuit-breaker switchboard of Allen West manufacture, type OB.13. This switchgear is of metal-clad construction, fully interlocked, air-insulated and vertical isolated, having a breaking capacity of 100 MVA. This board feeds two house transformers and two mercury-arc rectifiers, and also provides a high-voltage supply for the coal-handling plant, water-cooling plant, by-product plant and coke-handling and producer plant. The switchgear, which is in the basement, is controlled from a sheet-steel cubicle board mounted in an annexe off the turbine room. A duplicate synchroscope is installed in the turbine room to permit synchronising of two machines by hand control of the speed in the event of failure of the remote speed-adjusting gear. The alternator neutrals are earthed via a liquid resistance and an oil circuit-breaker.

The house transformers are of the English Electric oil-immersed, naturally-cooled core type, each rated at 750 kVA, having a ratio 3,300/433 V. These feed an

all-panel, 415 V, four-wire switchboard which is a Crompton Parkinson "Klad A," vertical isolation, oil circuit-breaker, manually-operated, having a breaking capacity of 25 MVA. Supplies are taken from this board to the boiler house and circulating-water pump house, and to distribution boards for the power house auxiliaries.

The d.c. supply is obtained from two English Electric rectifier equipments, each rated at 300 kW at 22 V d.c., and comprising an indoor-pattern rectifier transformer and one sealed air-cooled steel tank rectifier unit. The rectifier cubicle has double-front access doors and contains all the necessary ignition, excitation and fan-cooling auxiliary apparatus associated with the tank, this apparatus being supplied from a tertiary winding on the main rectifier transformer, ensuring automatic starting-up when the primary a.c. circuit-breaker is closed.

A supply from these rectifiers is led to an English Electric flat-back type d.c. switchboard which provides a supply to the oven machines. A loading resistance is provided to suppress the voltage to approximately 235 V at low-load values of current, and equipment is provided to absorb any regenerated power from the d.c. system and thus avoid an excessive voltage rise.

A Chloride lead-acid storage battery is provided for a d.c. supply to the switchgear solenoids, tripping and alarm circuits, turbine gauge panels, diesel engine services and emergency lighting in both the power house and boiler house. The battery consists of 55 closed lead-acid cells, 110 V nominal, having a capacity of 200 A at the 10-hour rate of discharge at 60 deg F. A "Cycloc" automatic float charger is installed, operating on a 230 V, 50 c/s single-phase supply. The a.c. and d.c. power distribution systems are fed through English Electric "Combination" fuse switchgear.

Electronic Control of Industrial Processes

A LECTURE which Mr. E. J. P. Long delivered to the Institution of Engineers-in-Charge recently was devoted to a consideration of the electronic control of industrial processes of which, he said, there were many examples in the chemical industry and to a more limited extent in steel, paper and textile manufacture and in printing. Continuous control in the latter processes was facilitated by the material being in strip form, and while the manufacture of individual components was more difficult to deal with in this way a project for the production of radio receiver circuits had been successfully demonstrated in this country. This consisted of a chassis with a plastic base in which shapes for wiring and for inductive and capacitive components were successively formed. The conductive paths were sprayed, valve holders and other preformed components added and the whole tested in one continuous process. In the United States a system for the production of an amplifier built up on a number of wafers had been devised, while in Russia plant had been designed for the production of pistons for internal combustion engines in which a machine was fed with aluminium ingots and the pistons were cast, machined, gauged and delivered wrapped.

Dealing in detail with processes in which the power drive was under continuous control, the lecturer pointed out that in the production of steel strip the metal was reduced from the ingot by being passed through a succession of stands, the speed of each of which must be greater than that of the preceding one by an amount depending on the elongation of the metal. The speed correspondence between the several stands must be accurately maintained during rolling and a high rate of production had been rendered possible by the application of automatic control to the reversing and tandem mills, to such auxiliaries as the screw-downs and feed tables and to the uncoiling and to the re-coiling, shearing, scaling, annealing, tempering, plating and trimming processes. Mill and reel voltages and speeds, strip tension and compensation for changes in reel diameter had also all been made subject to closed loop regulation.

In the paper and textile industries the principal processing stages, in which high precision control was essential, were in the initial production of the paper and synthetic fibres from the liquid state, in reeling control and in the printing of the finished paper or fabric. In the production of paper the initial mix was water with a 0·5 per cent suspension of fibres. Moisture was successively removed by suction and heat until the material became dry. For some types of paper the speeds of the sections at the dry end must be maintained within 0·05 per cent to prevent sagging or breaking of the sheet. This regulation must be effected despite the wide range in the value of the electrical and mechanical time constants of the couch, press, drying, calendering and reel sections of the machine and in spite of disturbances due to variations in the couch vacuum, press and calender friction and pressure.

In the production of synthetic fibres, such as rayon and nylon, a viscous fluid was forced through a spinneret by an electrically driven pump and emerged as a filament, groups of which were combined into a strand, cooled and passed over a finishing reel and feed wheel on to a drum. The gauge of the thread was determined by the relationship between the speeds of the pump and the feed wheel, which must be maintained within about 0·1 per cent.

Machine Tool Control

The first step in the automatic control of machine tools had been to fit the various motions, such as work tables, tool holders, spindles, chucks and rams, which had hitherto been operated by the same motor, with independent drives. Apart from eliminating cumbersome gearing this enabled the machine to be more easily manipulated by press-buttons and to be fitted with infinitely variable speed control, which was adjustable while the machine was in operation. This facility enabled the cutting speed to be maintained constant through a facing operation while the tool was moving rapidly. The speed of the table drive of a planing machine could be maintained at a pre-set value during the cutting stroke irrespective of the variation in load and in cyclic reversing drives rapid braking might be obtained by inversion. The main contactors could be operated at zero current when grid control was employed to block rectifiers feeding the d.c. driving motor.

Monitoring the position of the work table by using a Magslip for each decimal digit enabled its co-ordinates to be displayed electrically, thus avoiding the strain of reading small vernier scales. The operator could then position the table according to this indication, while a further refinement enabled him to set the co-ordinates by dials. On pressing the start buttons the table would then be driven to a position cancelling the set values by the data fed back by the Magslip.

Beyond the Motor Coupling

The Wider Responsibilities of the Maintenance Electrical Engineer

By A. W. LEADBEATER*

PROBABLY the largest consumer of electricity in this country to-day is the steel industry and one of the most important groups of people in it is that connected with maintenance of electrical plant.

Whilst some specialisation is creeping into the ranks of maintenance electricians due to the advent of advanced electronic systems and v.h.f. communications, the true electrician is in many ways a widely experienced man. Particularly is this the case in steel plants where knowledge of cable laying, jointing, h.v. and l.v. switchgear, motors, control gear and, not least in importance, knowledge of schematics of varying complexity is required. The electrician shares full responsibility for the maintenance of a large plant alongside his counterparts in mechanical and civil departments, since all services will come under the direct control of these three main sections.

It is evident that there has to be very close co-operation between the electrical and mechanical departments, as in many cases representatives from both sections together diagnose a plant trouble. One of the most controversial matters has been the line of demarcation between electrical and mechanical responsibility, and there are many cases of overlapping.

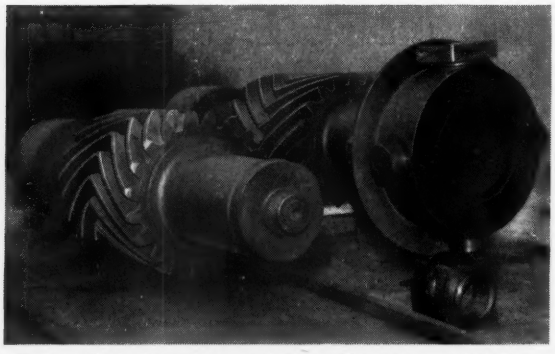


Fig. 1.—Pinions for a 32in mill drive. These have a 5,000 h.p. normal rating, 14,000 h.p. peak and have a maximum r.p.m. of 160. The p.c.d. is 33·8in

Fig. 2.—A half-coupling with outer muff for a 5,000 h.p. 0/80/160 r.p.m. 800 V d.c. motor

Let trouble with an electric motor serve as a typical example. In many plants it is generally accepted that the electrical department's responsibility ends at the motor coupling. This can and in most cases does mean that the electrician having taken off three, possibly six, wires from a faulty motor ceases to take further interest until the motor is changed. The changing of the motor may be done by mechanical fitters or possibly fitters will loosen off the holding down bolts, take out the coupling bolts and leave the handling of the motor to an entirely different squad of riggers. This may comply with certain regulations as laid down in a particular plant but does not always make for the most efficient method of working.

The scheme works well enough when trouble occurs during dayshift hours when the plant is fully manned in all sections. Unless a large staff is employed over the whole twenty-four hours, with the probability of periods of enforced idleness, trouble between 7 p.m. and 7 a.m. can result in expensive delay to plant while men are sent for, and brought to the plant. Another factor is that all three groups of men may come under different controls. If the fitters and riggers are under the mechanical engineers the system can work reasonably well but if the delay to the plant is electrical, and if other plant trouble of a mechanical nature is present at the same time, it is natural for the motor to take second place. The system is unfortunately dependent on personalities. An obvious solution is for mechanical fitters to be attached to the electrical department under the control of the electrical engineers and this system is adopted in some cases. Again, this system can only operate efficiently on a twenty-four hour basis and full use of available manpower becomes a problem when the plant is running smoothly.

How far then should the responsibility of the electrical engineer extend? Should his interest reach further than the motor coupling? It is interesting to note at this stage that in India, where complete control of steelworks by local engineers is relatively new, and where new ideas are being sought everywhere, all cranes are put under the control of a staff electrical engineer. His job embraces a group of cranes, including responsibility for ropes, wheels, shafts, gears as well as all electrical controls. So that whilst the immediate reaction to extended responsibility for the electrical engineer may be negative, there are factors on the other side of the motor coupling which indirectly concern the electrician and have many times been the cause of personal friction. The writer feels strongly that it is the duty of the electrician to at least be familiar with some of the factors beyond the coupling.

In the modern steel plant few drives are by flat or "V" belts. In particular cases where such belts are used, such as on large crushers, they are most efficient and fulfil their task of giving maximum flexibility. They rarely give the electrical man cause for complaint providing he realises the importance of, and insists upon, an outboard bearing on the motor pulley. All other drives are directly coupled or indirectly coupled through a suitable gear box. The former are in the minority for rarely does a motor speed

* Stewarts & Lloyds, Ltd.

exactly suit the driven machine. Motor speeds are essentially limited in number; a.c. motors must conform with a multiple of 50 c/s taking into account slip, but the experienced electrical engineer will keep the number of different types of motor on any plant to the minimum in order to keep his spares under control. This policy has been adopted universally on the d.c. mill type motors which are used very widely in steel plants; it can be assumed that most d.c. drives above 25 h.p. in this class will be between 400 and 600 r.p.m.

An outstanding example of direct coupling is the large d.c. drive to heavy rolling mills. A typical case could be the supply of power to the two steel rolls of a mill which may require an average power input of 10,000 h.p. with peaks of 22,000 h.p. on a reversing cycle of 110/0/110 r.p.m. Early designs utilised a single motor drive, either a single armature or double armature in tandem, and the power was split up through a 1/1 pinion housing so that each roll received its share to transmit to the ingot. Fig. 1 shows a typical pair of double helical pinions for this duty. The motor is fitted with a similar half coupling, having four radial trunnions of 8½in diameter on which fit four square brasses. When the coupling halves are in line a split muff having axial keyways is bolted and keyed overall, and the drive is transmitted from the four brasses on the motor coupling to the brasses on the first pinion via the muff.

Strictly, this is not a flexible coupling but should be classed as a universal type as it allows slight out of line operation without tangential movement. In fact, any appreciable slack in rotation should be avoided on a reversing cycle. In Fig. 2 the motor coupling is seen on the left and half the muff with one brass fitted on the right. The latest development dispenses with the gearbox and two separate motors, mounted as close as possible, drive the individual top and bottom rolls respectively. Load sharing is arranged electrically by suitable interconnection of the motors.

Live Roll Drives

Much lower down the scale, direct drive is often found on live rolls which are used as roller conveyors to trundle hot slabs from one operation to another. Figs. 3 and 4 show two different types of motor performing this duty: in the first illustration a 9in square hot billet is shown passing along the roller track.

Live roll drives have had their particular problems for a long time, mainly because of the adverse heat and dirt conditions which have to be met. The drive is often from an a.c. supply and the rolls are required to revolve at between 100 and 300 r.p.m. In earlier designs special a.c. motors were developed having 20, 24 or 32 poles and whilst these still give good service they present a heavy maintenance problem due to the tight small-span coils in the stator, the resulting small sectioned teeth in the core and the small permissible air gap necessary to obtain the required torque. It will be evident from Fig. 3 that in some cases the motor carcase can be subjected to excessive heat, resulting in bearing grease loss, and ultimate bearing failure; the rotor will then pull over and stator and rotor teeth will be damaged. Fig. 5 shows a typical stator and rotor of this class, and Fig. 3 the same type in operation.

Another design makes use of orthodox speed motors with integral gearboxes and these perform successfully on constant speed or non-reversing duty, but the inherent backlash in the gearbox sometimes leads to gear trouble, and the gearbox is extremely vulnerable to damage from outside sources.

All these motors require some form of coupling to the live roll, and this can present a minor problem. Fig. 6

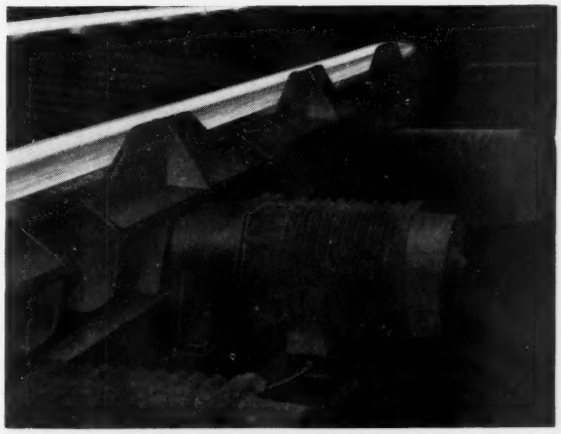


Fig. 3.—Live roll motors, direct coupled. These are rated at 3 h.p. 420 V and have 20 poles

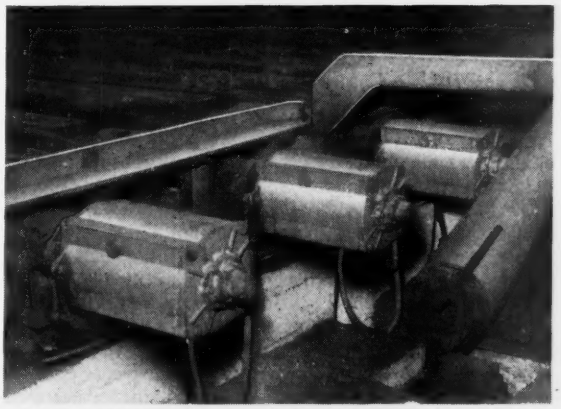


Fig. 4.—Other live roll motors, direct coupled 53/27 r.p.m. variable frequency machines

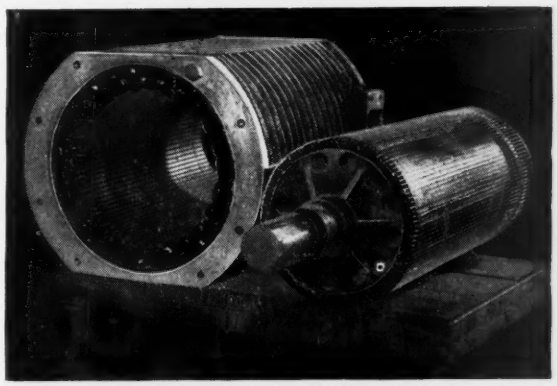


Fig. 5.—Stator and rotor of 17 h.p. 32 pole machine like that in Fig. 3 after a repair due to rubbing on bearing failure

Fig. 6.—Types of coupling for live roll drive: an indication of development after trials under working conditions

shows a number of motors picked at random to illustrate this point. The small gear drive has already been discussed; the centre top machine has the original type of pin coupling which gives reasonable service but is expensive on pins which must be of a special steel, whilst the top right leather stud coupling is not good under heat conditions. The merits of the Bibby coupling are well known providing grease can be regularly fed to the spring faces and abrasive dirt kept out; the illustration shows a motor recently taken out of commission without cleaning and needs no further comment. A gear type coupling was tried having a toothed muff but was discarded for the simple claw coupling shown on the bottom right hand, which engaged with a Tufnol maltese cross arrangement. So far this coupling has proved very satisfactory.

A modern trend is towards direct drive with low frequency motors supplied from a suitable frequency changer and this scheme has much to commend it. The arrangement dispenses with a coupling entirely, the live roll having an extended accurately machined tapered shaft on which the completely assembled motor is mounted. Fig. 7 illustrates this, and shows both ends of the same class of motor, the machine being virtually a standard type motor with a hollow taper shaft. The removal of the end cap shown on the right hand machine allows a suitable box key to be used for tightening the machine on to the shaft. As shown in Fig. 4 the stator body is anchored by short adjustable tie rods, the weight of the stator and end bells being carried on the bearings.

Without detracting from the performance, design and originality of this type, there are factors which have to be carefully watched by the electrical man. The fine finished taper shaft is part of the live roll; when the motor is withdrawn the roll complete with taper may come under the direction of another department, which is not particularly interested in the taper part of the job, and damage can occur. Another hazard is when the motor has to be fitted with the roll *in situ*—a careless or misunderstood signal to a crane driver may result in a slightly bent taper, causing an unsightly wobble of the motor when in operation.

Drives for Fans and Pumps

Fans and pumps are often directly driven, and both can be designed to run at one of the asynchronous speeds. From the electrical point of view it is as well to avoid a speed of 3,000 r.p.m. although this is sometimes specified for high-pressure pump units. Cage type rotors are always used when speeds of this order are required and in the writer's experience high torque rotors have an advantage over the straight cage when high inertia fans or pumps have to be accelerated. The reason is that an excessive rush of starting current plus the length of time required

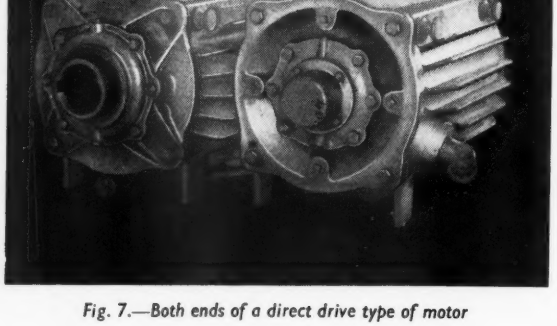
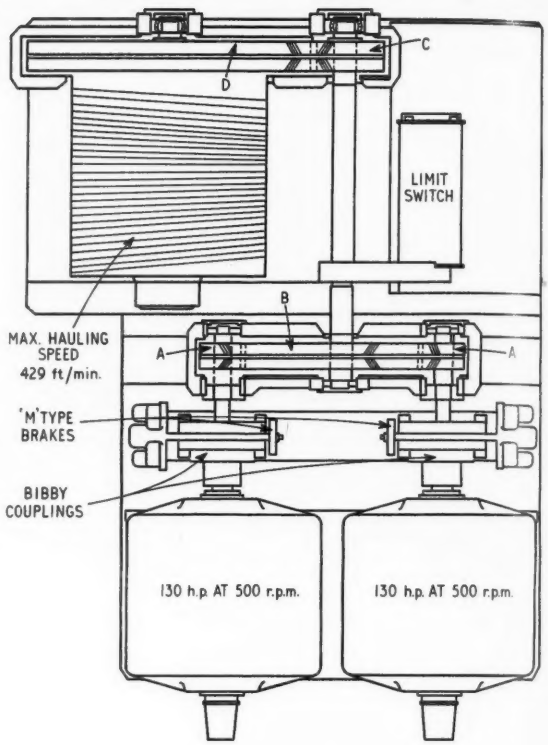


Fig. 7.—Both ends of a direct drive type of motor



Sym	Teeth	D.P.	P.C.D.	Face	Bore	R.P.M.	Remarks
A	24	2″	12″	7″	5″	500	Double Helical
B	96	2″	48″	7″	6″	125	Double Helical Welded Const.
C	24	1¼″	19·200″	10″	6¼″	125	Double Helical
D	98	1¼″	78·400″	10″	5′ 8″	30·8	Double Helical Welded Const.

Fig. 8.—Outline of a double motor haulage drive, a design proved satisfactory over 10 years of arduous duty

to attain full speed has an adverse effect on a unit which at all times requires to be perfectly balanced dynamically. The writer has seen rotor bars fused into slots due to this hazard and in one case on the Continent observed efforts to rectify this mistake by fitting a smaller donkey motor to bring the main fan up to ⅓ speed before the main motor was switched in. Admittedly, the inertia in this particular case was very high.

The number of drives requiring gear reduction in the steel plant is large. Practically every type of gear train is encountered at some stage between the ore and the finished product. Beginning with mechanical drag lines, already themselves covering most types of gear units, the field also includes haulage machinery, tipplers, conveyors, skip hoists, cranes and traction units. One of the most common drives is the worm-gear, either as a single unit or coupled to a final spur drive; this has the advantage of being compact, silent and without vibration in service. It is used on conveyor drives where large reductions are required in a restricted space. Efficiency, however, may be relatively low and heat generation may result on overload. The opposition to driving back on the motor is often an advantage on conveyor drives, but sometimes a disadvantage on machine drives where the inertia of the machine is great. It is an ideal drive from the electrical

engineer's angle, since the vibration transmitted back to the motor is negligible and the whole gear unit is encased in its own box thus allowing the motor to be lined up to the gearbox coupling with some degree of accuracy. This enclosing of the gear is an essential part of the design to ensure adequate lubrication.

One of the most common and cheap arrangements is a system of straight spur gears. In order to get the required ratio, three or sometimes four motions have to be accommodated. The main advantage is high efficiency. Straight spur gears are acceptable on large diameters providing that the pinion is not too small. When it is necessary to keep the number of reductions to the minimum it is usual to employ helical gearing for the first motion, retaining straight spur for the final drive. The writer prefers a system in which the motor drives through a flexible coupling such as a Bibby, with the first motion shaft carried on two bearings, as close to the pinion as practicable, and all pinions and wheels double helical. Fig. 8 is an outline drawing of such an arrangement and shows a double mill motor drive on a haulage unit. The motors are lined up on a common bedplate, and drive through Bibby couplings to pinions rigidly held between roller bearings, each driving on to a common double helical wheel. The final drive to the rope drum is again double helical and this arrangement has proved most satisfactory.

Haulage drives may not always be designed to this standard and Fig. 9 illustrates an example to be avoided. In this case a single motion drive employing an extension shaft bolted on to a solid spigoted coupling carries the double helical pinion, an outboard bearing being the only other means of support. With such an arrangement it is practically impossible to line up the motor and gear to the degree of accuracy required, and the lack of rigidity leads to endless trouble. On large continuous mill drives the gearboxes are self-contained units employing double helicals or an arrangement of opposed single helicals, each unit having an efficient lubrication system. Suitable couplings provide a degree of flexibility to the motors. In many cases it is not economic to employ helicals on all motions and the second and final drives are often straight spur, this is also shown in Fig. 9.

It is important to avoid the transmission of vibration to the motor. With the possible exception of the worm-gear all gearing causes vibration to a varying degree, the straight spur heading the list of offenders. The gear manufacturer will assert that the amount of vibration is of no consequence and there is no doubt that for a machine shop fitted train of gears the vibration can be reduced to a reasonable figure. But in practice where the fitting and lining up has to be done under conditions of dirt, heat and pressure of breakdown emergency, gear trains never seem to run as precision machinery. The vibration can be of alarming magnitude with consequential damage to motors. Common faults due to this cause are recurring flats on commutators and slip rings, often a definite pattern; loose commutator "V" rings with resulting high bars; loose field coils on pole pieces; conductor slot faults; roller bearing faults often denoted by wave formation; and even shaft crystallisation, with breakage.

Possibly the worst condition under this heading is the case of a motor fitted directly with a pinion driving gear; the traction engineers are fully aware of this and have gone to great lengths to ensure accurate fitting of pinions with ground helical teeth and substantial motor bearings. Unfortunately there are motors doing a similar duty in industry which have not had the same thought applied to their design.

Brake Systems

Closely connected with motor drives and gears is the application and positioning of brakes. There are different methods of electrically operating brakes but the basic mechanical application is the same and consists essentially of a brake wheel with lined brake shoes, spring or gravity weight operated. A brake wheel can be directly on the motor shaft, on mill type motors sometimes on the outboard end, but usually on the inboard shaft extension. The brake wheel is often part of the coupling with the Bibby half component either driving the first motion shaft or alternatively being driven by the motor shaft.

The difference is that in one case brake shock is taken through the Bibby to the load and in the other only the inertia of the armature has to be accommodated by the coupling. This is of some importance and can influence the life of the coupling. More important is the effect on the gears; in the ideal arrangement the electrical schematic allows the machine to be brought to a standstill before the brake is applied, but in practice this is not always the case.

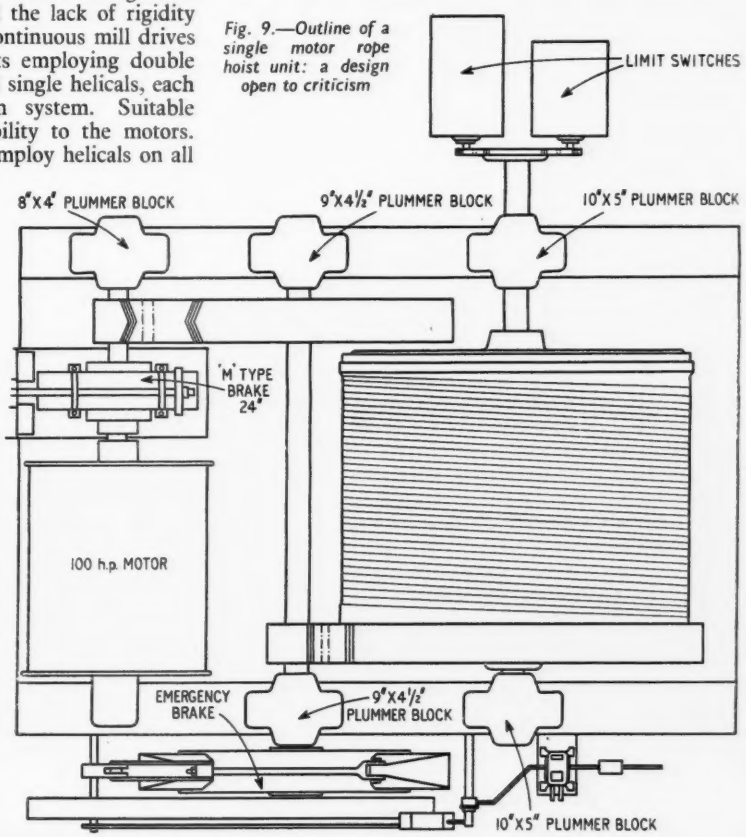


Fig. 9.—Outline of a single motor rope hoist unit: a design open to criticism

There are many instances where the operator can switch off a machine running at full speed and thus bring in the brake action suddenly with consequential shock to the gear train. This can lead to subsequent failure of the gear and serious consequences such as dropped crane loads, runaway wagons on haulage or a skip hoist crash.

Brakes are fitted on the motor or first motion shaft because it is most practicable and economical; they are thus kept to the minimum size, and act most efficiently in this position; but the fact remains that every tooth in the gear train is vulnerable and subject to shock stress. Broken shafts and stripped gears are not unknown. The theoretical position for brakes is the final motion shaft or drum in the case of haulage gear, but often such an arrangement is clumsy, unwieldy or difficult to accommodate. Arrangements are sometimes made for two brakes, one as a service brake on the motor shaft, the second as an emergency brake on the drum. In practice the emergency brake is often slow in operation and in case of gear failure the drum may attain a high speed before the brake can act, resulting in a mishap.

The problem has been seriously studied on pit winding gear where human life is at stake and the writer considers that more attention should be given to this application in industry. The case of brakes applied on the motor shaft in conjunction with a worm-gear drive is worth mention. Here the efficiency is dependent on the gear ratio, condition of teeth, and lubrication, and it is well known that in certain cases such a gear will oppose drive back. When used in conjunction with a travelling machine of considerable inertia the braking action is exaggerated and it has been known for the gearbox casing to fracture due to the wedge action of the wheel against the worm on brake application.

Gear Ratio and H.P.

Most engineers will contend that the deciding of any gear ratio is a simple matter of correlating a known belt, rope or travelling speed with a suitable motor. Inasmuch as motor speeds are fairly standardised, for most practical purposes they are probably justified in their contention. Manufacturers of conveyor belts will have their own particular formula for calculating conveyor h.p. and gear ratios taking into account their own past experience and it is this which really matters. It is one thing to start up a new conveyor belt with a new gearbox, all idlers new and properly greased, but quite another story after a number of years when everything becomes a little worn, the greaser has the morning off, and the usual accumulation of stone, ore or coke dust has built up round the idlers. In the past there appeared to be a tendency to keep motor h.p. to the minimum on conveyors but experience has tended to rectify this. It is always considered policy to run any a.c. motor at as near full load as possible for reasons of initial cost and power factor but an allowance should be made for plant deterioration and the possible overloading of belts by operators.

Similarly, on cranes the hoist motion h.p. can be simply estimated and efficiencies allowed for. The cross travel and long travel motion calculations are different and it has been recognised for some time that cranes can be classified into groups of high and low performance. High-speed cranes such as chargers, strippers, billet and bar magnet cranes will require special attention to the acceleration factors in performance calculations, since speed of operation is an important part of production. The lower performance machines, usually ladle cranes, require most attention to smoothness of operation and calculations will be based on tractive effort constants. In recent years a great deal of thought has been given to motor horse powers and gear ratios where machines of great inertia have to be moved. The quest has been to relate mass displacement with time and to decide the most economic size of motor to use. A paper read by Guthrie before the Iron and Steel Engineers' group* gave a new approach to the problem. Where a heavy mass has to be accelerated and moved over a certain distance, the length of ultimate travel will decide the relative importance of the acceleration and the final speed. If the mass has to travel only a few feet then acceleration is the dominant factor, and it is evident that for a given h.p. the gear ratio will be different for each case. The theory is applied to a roller table which may carry a billet or ingot of one to six tons and has to move the product a short distance from one operation to the next in as short a time as possible.

It will be evident that there are other drives with similar characteristics such as manipulators which, heavy masses in themselves, are called upon to shift a six to eight ton ingot a matter of inches many times in a rolling operation. Whilst the long travel motion of a crane could be considered in this light, the duty of a crane is often wide, and although a great deal of its operational time may be over very short distances, runs down the full length of the shop also have to be taken into account. In any case the mass displacement time theory is more applicable to operational times of less than six seconds; above this time the gear ratio to give the maximum speed begins to dominate.

Conclusions

Up to this point, what has been written only lightly touches the subject: it must be evident that many of the electrical engineers' troubles begin beyond the motor coupling. Worn gears and bearings resulting in damaging vibration and excessive motor bearing loads do occur, and when time is taken to rectify these, it is often found that the electrical department has also a major overhaul on its hands. Sometimes it is not realised by outside parties how far the damage has extended; new motor casings are required when bearing housings have been subjected to hammer, and how many times is it found necessary to re-core both stator and rotor after a motor bearing failure due to outside causes? One of the most common faults transmitted back to the electric motor is end-thrust, against which the motor is so inadequately provided. A simple example is that of some types of flexible couplings; too great a clearance between coupling faces allows an excessive bending moment resulting in an undesirable end thrust component.

A much more destructive action is found to result from the claw type or crude square shaft coupling drives; when these become worn, they set up an effective screw action capable of destroying the motor bearing in a very short time. This leads to the conclusion that it should be possible to set down any motor on a substantial foundation, and line up to a coupling having flexibility with axial rigidity. Can it be taken as significant that a certain plant, which was fitted with fluid coupling drive throughout, has been in operation for eight years without motor failure?

Contrary to the policy in other countries, the maintenance electrical engineer is often considered as a second string. This is probably an heirloom from the days when steam, water and wind provided all motion and the old engineer was a law unto himself. In some circles the feeling still exists that the electrician has developed from the boy who changed electric light bulbs. How long must the motor coupling be the garden wall over which many heated words fly and a deadlock develops whilst it is decided whether it is electrical or mechanical ?

* Proceedings of the Conference on the Rating of Mill Type Motors B.I.S.R.A. No. PE/Conf./6. 1951.

Electricity Bill Omissions

By D. J. Bolton, M.Sc., M.I.E.E.

THE new Electricity Bill, which was summarised in the *Electrical Review* of 7th December and received its second reading this week, plans a drastic re-shaping of an organisation which is not yet ten years old, and which only recently suffered a serious amputation through the loss of its South Scottish activities. The Bill is a valiant attempt to carry out most of the structural reforms recommended by the Herbert Committee of Inquiry into the Electricity Supply Industry which reported last January. It diverges from the Committee's recommendations in the direction of somewhat less commercialisation and somewhat more Governmental control, and above all in providing what is virtually a single-tier structure for the industry.

The Herbert Committee planned the industry as something of a pyramid of which the apex was to be a small but fairly powerful and independent body, the Central Authority, capable of (to use their own words) "keeping the industry on its toes and critically reviewing the Boards' policies, programmes and expenditures." Under the legislation now proposed the structure is not a pyramid so much as a group of single-storey buildings, a large one for generation and twelve smaller ones for distribution. Their activities are co-ordinated, but not controlled, by a body which is correctly described as a "Council" and not an "Authority."

SOME PROBLEMS WHICH THE NEW LEGISLATION WILL NOT SOLVE—AND MAY ACCENTUATE

This Council will partake somewhat of the character of the Gas Council, with a tincture of the one-time Electricity Commission, and its main functions will be to advise the Minister on electricity supply matters and to promote and assist the Boards in providing "an efficient, co-ordinated and economical system of electricity supply." Specifically, the Council will be responsible for negotiating the industry's finances, and will act as the Boards' agent in carrying out any other services (such as research) which are best performed in common. They will also correlate development programmes.

Pros and Cons of a Central Authority

The Government's reason for rejecting the Herbert Committee's recommendation of an independent Authority to control the industry is clearly stated in the White Paper which was published simultaneously, namely, that such a body might have great power over the industry with little corresponding responsibility. It would doubtless also lead to a certain amount of duplication and waste of expert man-power since a body capable of "critically reviewing" and, when necessary, controlling the Boards' policies and activities must have a highly competent and not inconsiderable staff.

There are, however, serious dangers in having nobody "on top" with a final executive authority over the industry as a whole. In the first place the absence of anything like a unified command must weaken the industry's capacity to act as a whole whenever it feels that a common front is necessary. The Council will not even necessarily act as the channel for Governmental control since the Minister may now go direct to any individual Board, whilst each Board (like the Council itself) will present its annual report directly to the Minister.

The second danger is an internal one, namely, that there will be no independent authority capable of resolving issues in which there is a clash of interests within the industry itself. The Council clearly has neither the authority nor the independence, since it consists merely of the Board chairmen themselves, with (at most) three outside appointments. Such a clash could arise in a number of ways but much the likeliest would be in connection with the price of bulk supplies.

It may be thought that the construction of the bulk supply tariff is a purely objective operation—a job of engineering to be done on a slide rule and based on technical and economic data which leave no margin for the personal equation. But this is far from being the case. Even in the proportion of the two parts there is room for a difference of opinion regarding where to place certain items, and whether or how much "tilt" shall be given. Opinion is coloured by interest, and the views of any particular Area Board are bound to depend on whether it has a high or a low load factor.

More serious than the question of proportions will be the question of total amount, and here the Generating Board and the Area Boards will be lined up solidly on opposite sides. Moreover, the issue will be of absolutely paramount importance to both sides. Virtually the whole income of the Generating Board is derived from the bulk supply tariff, whilst nearly 70 per cent of the Area Boards' expenses go in this direction. Increase the tariff by 5 per cent and the Generating Board will show a handsome surplus while every Area Board will be "in the red." Decrease it by 5 per cent and all the surpluses will be on the other side.

Herein lies the difficulty of applying the Herbert Committee's commercial criterion, that of running each Board as a separate economic concern and making it pay. The industry *as a whole* can be said to "pay" or "not pay" because it starts and finishes with products (fuel and capital on the one hand and heat and power service on the other) which are subject to competition and therefore capable of being independently costed. But the two branches of the industry cannot be separately assessed in this way because they are connected by an economic link which cannot be objectively determined.

It is true that most of the bulk supply tariff is factual since it must cover all the actual costs of generation—plant, fuel and operation—together with the normal overheads. But it must also include a proper allowance for administration (including, presumably, the expenses of the Council) and, in the average year, should provide a small surplus for contingencies and reserves. How should

these proper allowances be determined, and how should they compare with the corresponding figures for the Area Boards? It is arguable that the only correct way of putting the finishing touches to the wholesale tariff calculation is to adjust it so that, in the average year, exactly the same percentage surplus is made by the Generating Board and by the combined Area Boards. The emergence of a large surplus on either the generation or the distribution side would then indicate, not a superior economy but merely a maladjustment in the tariff.

Unfortunately the Bill, whilst trying to be helpful, does not really settle the matter. Clause 11 says "The prices to be charged . . . shall be in accordance with such tariffs as may be fixed from time to time by the Generating Board after consultation with the Electricity Council." The first part of the sentence places the onus of decision fairly and squarely on the Generating Board but the second part implies a "vetting" by a body whose composition represents a six-to-one majority of distribution interests.

Generation Divisions

Another matter on which the Bill gives no guidance is that of the future of the Generation Divisions. Since the two sides of the industry are of tolerably equal size (generation employing more plant whilst distribution employs more staff) and since there are twelve Distributing Boards and only one Generating Board the latter will be of far greater magnitude. A sub-division of its functions will clearly be necessary on administrative grounds.

The Herbert Committee stressed the dangers of over-centralisation, and on the distribution side the Bill has gone some way towards devolution by lessening power at the top and by making the Area Boards somewhat more self-contained, each having to balance its individual budget, etc. It would therefore seem logical to follow this by a devolution of generation and by giving more power to the divisional controllers. On the other hand there are some technical factors which oppose this centrifugal tendency and which make it more necessary than ever to operate the generation system of the whole country (Scotland as well) as a single unit. The use of the supergrid and the advent of atomic power will certainly mean a lessening of the proportion in which energy is consumed close to its generation point.

What seems fairly certain is that the sub-divisions of generation will no longer rigidly follow the lines of demarcation of the Area Boards. The latter, after all, were planned purely from the point of view of distribution, and whatever logic there may have been for following the same lines for generation it is less likely to apply to the new organisation. Already it has been departed from by the amalgamation of the North Western and Merseyside Divisions, and it would not be surprising to see a re-grouping based on purely technical factors such as those which guided the District divisions of the Central Electricity Board. There might well be considerably fewer Divisions than Area Boards and it is noteworthy that the C.E.B. had only seven or eight Districts including Scotland, and that even then some amalgamation took place.

Fuel Cost Variation

A minor consequence will probably be to make the present regional fuel clause of the bulk supply tariff inoperable. The Bill provides that where different prices are charged to different Area Boards for the same quantity of electricity the differences in the prices shall correspond with differences in the cost to the Generating Board. This will make illegal one of the chief reasons for the existing regional variations, namely, that of putting all Area Boards on a level in competing with alternative sources of power and heat. Since this is a purely selling factor and has nothing to do with the cost to the Generating Board it will be excluded in future.

The long-term consequences to the country of this provision may be considerable. Industry, which still continues to some extent to be attracted towards the cheap coal areas, will not have this inducement so far as electricity prices are concerned. Many large industrialists will find their electricity prices drastically adjusted, and there may even be some tendency towards removal or private generation. A factory manager with cheap coal on his doorstep may think twice about paying an electricity price based on conditions elsewhere.

The purpose of the provision is doubtless to extend the protection afforded by the undue preference and undue discrimination clauses to the purchasers in bulk. It is doubtful, however, whether any good purpose is served by tying the Generating Board's hands in this way, particularly as it must have repercussions on many of the long-term arrangements between the Area Boards and their clients.

Admittedly, the fuel clause is not a matter for the industry alone, since national policy is also involved, but this could be perfectly well communicated through the Minister. What is needed is flexibility to deal with the situation as it develops and not a legal enactment which may hamper the Board's actions in perpetuity. Doubtless the possible effects of this clause on the location of industry will be more fully examined when the Bill goes to committee.

Other Recommendations

Most of the Herbert Committee's recommendations which required legislation for their fulfilment have either been embodied in the Bill or rejected by the Government for very specific and well-defined reasons. What of the many internal and less fundamental proposals not requiring an Act of Parliament? These include the elimination of Sub-Areas and an increase in the numbers and powers of the districts; the offering of higher salaries to Board members and chief executives; intensification of utilisation and operational research and work study; provision for depreciation on a replacement cost basis; and a closer relation of tariffs to costs, even though this means greater complication. Some of these are no more than tendencies, already in hand, which the Committee wished to see speeded up. Others present difficulties—for example, the provision of a high rate of depreciation by one only of the fuel industries would militate against the free commercial basis of operation which the Committee so strongly supported.

It must be admitted that most of these minor recommendations are, to say the least, not likely to be helped by the latest development. With a new Act in the offing Boards will tend to hold up any proposed internal reforms until they see how the new order will affect matters. Activities such as cost research, which will presumably come under the Council, are not likely to be speeded up until the new body gets into its stride. There will be a tendency, however regrettable, to regard the Bill as the end of the matter, and to lose sight of the many other valuable suggestions in the Herbert Committee's Report. This is partly the Bill's own fault, for though many of these proposals do not actually require legislation they could certainly have been promoted by a judiciously worded clause or two.

VIEWS on the NEWS

By REFLECTOR

AS has been aptly said, this is a queer world. In Great Britain we have been turning to the use of oil as one means of helping out our inadequate coal supplies. In the United States there seems to be a move to encourage the greater use of coal to conserve oil resources. At least that is what I gather from a report in the *Electrical World* (New York) of some remarks by Mr. J. W. Barriger, president of the Pittsburgh and Lake Erie Railroad. Mr. Barriger urged the importance of electrifying American railways as a means of speeding up service and enabling them to carry larger loads. "Coal would return as the basic fuel, enabling the United States to conserve its petroleum resources." He went on to say:—

> "Electrification may be coming in the 1960 decade because insuperable handicaps imposed in the past on rail electrification have now been overcome technologically."

It is probably only in the United States, I may add, that insuperable handicaps can be overcome.

* * *

December 18th was the centenary of the birth of J. J. Thomson who, as Dr. J. Bronowski reminded us in last Sunday's *Observer*, was the father of modern atomic physics. In the course of his researches into the passage of electricity through gases, he found that the rays from a cathode could be deflected by magnetic and electric fields, showing that they consisted of particles and were not merely light waves. Thomson announced at the Royal Institution in April, 1897, that he had found a universal constituent of matter which was much smaller than the atom—this was the discovery of the electron upon which all subsequent developments in atomic physics were based. Later, Rutherford showed that the electrons in an atom circled about a central nucleus; Cockcroft, Chadwick and others, in the words of Dr. Bronowski, "took the nucleus to pieces."

* * *

In present circumstances an increase in bus fares is understandable but it is not so clear why London Transport should impose similar increases on trolley-bus and "Underground" fares. It is either taking advantage of the situation to bolster up its precarious finances or it is a believer in "equality of sacrifice"—that pernicious idea now so prevalent in Governmental and other circles.

* * *

An editorial note in the *Electron* (the official journal of the Electrical Trades Union) seems to have been written before the text of the Electricity Bill was published. It criticises again the recommendations of the Herbert Committee, particularly that which proposed that a reconstituted Central Authority should have powers of direction with regard to the negotiating and advisory machinery of the industry. Now that the text of the Bill is available perhaps the E.T.U. will revise its opinion, expressed in the following terms:—

> "It should be the first duty of the trade unions concerned to meet in conference for the purpose of protecting the employees in the industry from the ravenous appetites of the Tory monopolists at whose instigation the Herbert Committee was set up."

I may mention that this issue of the *Electron* is the Christmas number.

* * *

Many municipal people sigh for the old days of electricity supply when local authorities had their own more or less self-contained undertakings which, they all claim, produced a much more efficient and cheap supply than the national boards do now. For instance, the Town Clerk of Andover (Mr. J. F. Garner), writing to *The Times*, says:—

> "Local authorities . . . attained a high standard of efficiency and consumer service while observing a close relationship with local needs that is too often lacking among the regional boards of this nationalised industry."

Mr. Garner does not agree with *The Times* that the new Electricity Bill will lead to a thoroughgoing decentralisation of the industry. He thinks that this could be achieved only by a return of administration of distribution to local authority control. Even if his contention is justified Mr. Garner cannot hope to see the present system broken up again. In any case Andover was within the ambit of the Wessex Electricity Co. and so it did not lose its independence upon nationalisation.

* * *

Sixty years ago there was news of an electric ploughing system tried out in Germany. Reporting the matter, the *Electrical Review* of 18th December, 1896, said that power was transmitted to the field from a generator about two miles away at 2,200 V. Transformers on the spot reduced the voltage to 220 and supplied the power to a winding drum operated by a 28 h.p. motor. The drum pulled the plough along at a speed of about 50 metres a minute. The plough had four shares which together produced a furrow with an average depth of 30 cm and a width of 180 cm. "For tipping the plough, advancing the electrical windlasses, and recommencing the back motion at the ends, 1½ minutes was expended each time." It was calculated that with a field 300 metres wide 4,350 sq metres could be ploughed in an hour. The cost was said to be equal to that of steam ploughing or half as much as employing horse-drawn ploughs. It was pointed out that as the electric motors used could also be applied to other work on the farm, it was fair to distribute their cost over all the applications, thus reducing the cost of ploughing.

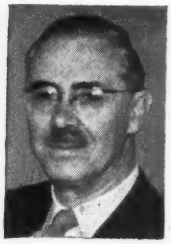
* * *

In this last issue before Christmas I extend my best wishes to my readers for the festive season and the coming year.

PERSONAL AND SOCIAL

News of Men and Women of the Industry

Mr. T. W. Heather, director and sales manager of the General Electric Co., Ltd., has been elected chairman of the Electrical Fair Trading Council for 1956-57. He succeeds **Mr. V. Watlington,** who has been chairman for the past twelve years. Mr. Heather



Mr. T. W. Heather

Mr. A. E. Iliffe

has been a member of the Council since its inception in 1933, and has been vice-chairman since 1944.

Mr. A. E. Iliffe, director and general sales manager of the Benjamin Electric, Ltd., who has represented the Electric Light Fittings Association on the Electrical Fair Trading Council since 1933, has been elected vice-chairman. **Mr. H. Riley** has resigned from the Council as the representative of the Electrical Wholesalers' Federation, and **Mr. P. B. Etheridge,** deputy director of the E.W.F., succeeds him.

Mr. Watlington was recently presented by Mr. Heather, on behalf of the Council, with a complete set of the literary works of Sir Winston Churchill, to mark his retirement from the chairmanship.

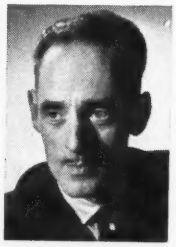
The Merseyside and North Wales Electricity Board has appointed **Mr. H. Telfer,** A.M.I.E.E., to be assistant chief engineer (operation) at the Board's headquarters, Liverpool, to succeed **Mr. P. C. Phillips,** who recently transferred to the Yorkshire Electricity Board as deputy chief engineer. Mr. Telfer is at present senior assistant engineer (planning) in the No. 1 Sub-Area of the Board in Liverpool. He was educated at Liverpool Technical College and served an engineering apprenticeship with the Mersey Docks and Harbour Board, Liverpool. From 1933 to vesting day he was on the staff of the Liverpool Corporation Electricity Supply Department and was appointed to his present position in 1951. Mr. Telfer is a past chairman of the Students' Section of the Mersey and North Wales Centre of the I.E.E. He takes up his new duties on 1st January.

Mr. H. Telfer

Mr. A. E. Keddie, principal assistant, organisation and methods at the M.A.N.W.E.B. headquarters, has been appointed an organisation and methods officer with the East Midlands Division of the National Coal Board.

The South of Scotland Electricity Board has appointed **Mr. D. M. McGrouther,** M.A., LL.B., as secretary of the Stirling Area. Mr. McGrouther is a principal legal assistant in the secretary's department, head office.

Mr. W. O. P. Jones, B.Sc.(Eng.), A.M.I.E.E., has been appointed assistant superintendent, Electronics Department, of the Metropolitan-Vickers Electrical Co., Ltd. Mr. Jones was educated at Abergele Grammar School, Wrexham Technical College, and the City and Guilds (Engineering) College, and joined the Metropolitan-Vickers Co. as a college apprentice in 1939. On completing his course he specialised in electronic work, and after the war he was appointed chief of test in the Transmitter Department. In 1953 he became manufacturing engineer in the Radio (now Electronics) Department.



Mr. W. O. P. Jones

Mr. W. C. Morgan, commercial manager of E.M.I. Electronics, Ltd., has been appointed engineering director of the company. He will remain in charge of contract sales and for the present will continue, jointly with the managing director, to be responsible for the company's general sales activities.

At a recent meeting of the Council of the Gauge and Tool Makers' Association the following officers were appointed for the 1956-57 session:—President, **Mr. F. W. Halliwell,** C.B.E., M.I.Mech.E., M.I.Prod.E. (chairman and joint managing director, Gay's (Hampton), Ltd.); deputy president, **Mr. S. J. Harley,** B.Sc., M.I.Mech.E., M.I.Prod.E. (chairman and managing director, Coventry Gauge & Tool Co., Ltd.); vice-presidents, **Mr. A. L. Dennison,** M.I.Prod.E. (chairman, Birmingham Tool & Gauge Co., Ltd.), **Mr. H. S. Holden,** M.I.Prod.E. (managing director, Brooke Tool Manufacturing Co., Ltd.) and **Mr. T. Ratcliffe,** M.I.Prod.E. (chairman and managing director, Ratcliffe Tool Co., Ltd.); chairman, **Mr. L. E. Van Moppes** (director, L. M. Van Moppes & Sons (Diamond Tools), Ltd.). With the exception of Mr. Ratcliffe, all the above appointments are re-elections.

The Minister of Fuel and Power has reappointed **Alderman A. Sturgess,** O.B.E., J.P., of Derby, and **Mr. G. H. B. Wilson,** C.B.E., M.C., A.F.C., J.P., of Nottingham, as part-time members of the East Midlands Electricity Board.

Mr. P. R. Maddock, of Solihull, Warwickshire, has been awarded the Birmingham Electric Club scholarship for 1956. Mr. Maddock is a student apprentice with the General Electric Co., Ltd., and is taking a sandwich course at the Birmingham College of Technology. He hopes to visit Europe and compare Continental with British technique in rotating machines and the design and layout of power stations.

Mr. W. C. Paterson has been appointed chief publicity officer of the Head Wrightson group of companies with effect from 1st December. His office will be at Ship House, 20, Buckingham Gate, London, S.W.1 (telephone: Victoria 6581).

Mr. A. W. Leadbeater, A.M.C.T., A.M.I.E.E., who writes in this issue on "Beyond the Motor Coupling," is chief electrical engineer at the Corby Iron and Steel Works of Stewarts & Lloyds, Ltd. He is a native of Southport and received his education and training at Rochdale Technical School and Manchester College of Technology. He served his apprenticeship with Whipp & Bourne, Ltd., and joined the Metropolitan-Vickers Electrical Co., Ltd., in 1930 as switchgear test engineer, later transferring to large machine test and finally to the plant engineering department. Mr. Leadbeater became assistant chief electrical engineer at Corby in 1940 and took up his present position in 1949.

Mr. A. W. Leadbeater

Colleagues of **Mr. W. A. Lane,** formerly general sales manager of Smiths Clocks & Watches, Ltd., recently presented him with a silver tea service at a dinner to mark his retirement held recently at the Russell

Hotel, London, W.C.1. When he joined Smiths in 1932 Mr. Lane was exclusively connected with the electric clock side of the business, and on his retirement was responsible for sales through all the company's sections. Mr. Lane has now formed a new company under the title of Watches & Clocks, Ltd.

Mr. N. S. Richardson, Croydon branch manager of Alliance Wholesale Ltd., has been appointed a director of the company with effect from 1st December.

Mr. N. S. Richardson

The Secretary of State for Scotland has appointed **Lord Provost William Hughes,** C.B.E., Dundee, as a member of the North of Scotland Hydro-Electric Board until 31st December, 1959. **Sir John Erskine,** G.B.E., Edinburgh, **Mr. A. I. Mackenzie,** Glasgow, and **Treasurer G. R. McIntosh,** C.B.E., Aberdeen, have been reappointed members for a further term with effect from 1st January next.

Mr. Derek Ibbotson is to take up a position with W. T. Henley's Telegraph Works Co., Ltd., on 1st January. Mr. Ibbotson is the well-known Olympic athlete who gained a bronze medal for Great Britain in the 5,000 metres race at Melbourne and is one of the few who have run the mile in less than four minutes.

He received his training as an electrician with the British Electricity Authority and the National Coal Board and gained a higher national diploma in electrical engineering. After a period of training in Henley's sales organisation and at the various works, Mr. Ibbotson will commence as an outside representative.

Mr. J. Ballentine has been appointed to represent Bill Switchgear, Ltd., in Northern Ireland. His office is at 23, Bedford Street, Belfast.

Mr. L. S. Crutch, B.Sc.(Eng.), M.I.E.E., has been appointed a director of Siemens Brothers & Co., Ltd. Mr. Crutch was educated at Dulwich College and University College, London, and received his early training with the International Standard Electric Corporation. Joining Siemens Brothers in 1931 he became head of the Telephone Transmission Department in 1935 and assistant chief engineer of the Telecommunications Department in 1945. He has specialised for many years in the development of telecommunications systems and in 1952 he was appointed transmission branch manager. Subsequently appointed assistant to the commercial director he later became deputy chief engineer of the company, his present position.

Mr. L. S. Crutch

The award of a first prize silver medal in illuminating engineering (final examination, 1956) to **Mr. G. V. McNeill,** Graduate I.E.E., has been announced by the City and Guilds of London Institute. Mr. McNeill is with the Atlas Lighting Division of Thorn Electrical Industries and is in charge of the discharge lighting section of the Technical Sales Department. Earlier this year he was awarded the A.S.E.E. Highfield Shield for a technical paper on "Industrial Lighting Economics."

The annual dinner dance of the Glasgow Branch of the **Electrical Industries Benevolent Association** attracted a large and representative gathering of electrical men and their ladies to the Grosvenor, Glasgow, on 11th December, when Mr. J. Gogan took the chair after he and Mrs. Gogan and Mr. H. Riley (president) and Mrs. Riley had together welcomed the guests. Mr. Gogan spoke briefly after dinner welcoming the president and Mrs. Riley and thanking the donors of gifts handed over for the funds. Both he and Mr. Riley stressed the need for continued support.

Mr. A. J. Moseley, managing director of Coventry Electrical Appliances, Ltd., has been appointed a director of Newey & Eyre, Ltd.

At the invitation of the chairman and directors of **Simmonds Aerocessories, Ltd.,** approximately 200 purchasing officers and design engineers, representing many well-known engineering and electrical companies in the London area, attended a social evening at the Park Lane Hotel, London, last week.

At the function, which is now coming to be regarded as an annual event, the opportunity was taken to show the new self-locking nut film, "Nothing Rattles the Nyloc," together with the "Spire" speed nut film, "Hold Tight." The films, which run for 20 and 25 minutes respectively, show how time and money can be saved by the adoption of this form of fixing in almost every industry, including domestic electrical appliances, engineering products, motor car production, and the heavier electrical equipment. Samples of the wide range of the company's self-locking nuts were on view and afterwards the guests were able to examine a display of components in which the nuts are used.

OBITUARY

Mr. F. N. Rendell-Baker.—The death occurred on 15th December, at the age of seventy, of Mr. Frank Nelder Rendell-Baker, M.I.E.E., who for many years was chief engineer and general manager of the Croydon Corporation electricity undertaking. Mr. Rendell-Baker served an apprenticeship with the Bolton Electricity Department and later held positions at Darwen and Farnworth before going to St. Helens, where he subsequently became chief electrical engineer and manager. In 1924 he took up a similar position at Halifax. He was appointed chief of the Croydon electricity undertaking in 1931, retiring from this position in 1948, although he continued with the Corporation for some time after that as consultant for the new Croydon power station and as adviser on street lighting matters.

Mr. S. B. West, A.M.I.E.E., general manager of the Clayton Equipment Co., Ltd., Hatton, Derby, died on 1st December at the age of sixty-five after a short illness. Mr. West had been concerned for many years with the development of electric locomotives of the type used for underground mining service.

The late Mr. S. B. West

Mr. Ernest Morris Jones, founder in 1923 of the Manchester electrical contracting firm of Jones, Morris & Co., Ltd., has died at the age of seventy-six.

I.E.E. President's Appeal

In making the customary personal appeal to members of the Institution of Electrical Engineers on behalf of the I.E.E. Benevolent Fund, Sir Gordon Radley, the President, says that the income of the Fund has increased slightly from year to year but the fact remains that it has not risen as quickly as the cost of living. A grant from the Benevolent Fund that was just sufficient two or three years ago for a minimum standard of living is inadequate to-day.

Much more could be done if the 27,000 members of the Institution who are not members of the Benevolent Fund subscribed regularly. Five shillings from each of them would add 50 per cent to the income of the Fund. Sir Gordon points out that the annual contribution may be added to a member's Institution subscription, or paid by bankers' order. Better still is to pay under the covenant scheme and thus enable the Fund to claim repayment of income tax on the contribution.

Although the Homes Fund is receiving steady support the target figure for the development of "The Chesters," the estate on which the houses are situated, has not been reached. The amount so far subscribed or promised is about £44,000 and Sir Gordon hopes that more will be received in the coming year.

IN THE COURTS

Manchester Bribery Charges

AT the Manchester County Magistrates' Court last week four Manchester men pleaded "Not guilty" to charges under the Prevention of Corruption Act. They were sent for trial, bail being allowed. The defendants were Fred Gilmour, managing director of Gilmours (Manchester), Ltd.; George Thomas King, purchasing agent with the Metropolitan-Vickers Electrical Co., Ltd.; Cyril Herbert Smith, works engineer with Metropolitan-Vickers; and Arthur Smith, surveyor.

Gilmour was accused of giving a car, a television set and a carpet to the other defendants and decorating their houses as inducements or rewards. He was also charged with uttering forged documents purporting to be estimates and specifications from other firms for painting work at the premises of Ferguson, Pailin, Ltd.

G. T. King was charged with accepting the decoration of his house as an inducement or reward; C. H. Smith with accepting a car valued at £778 and the decoration of his house; and Arthur Smith with accepting a television set, a carpet and the decoration of his house.

Mr. D. Karmel, Q.C., prosecuting, said that Arthur Smith worked under C. H. Smith, who, with King, was responsible to the company's directors. King decided who should have the contracts. Between 1951 and 1955 many tenders were received but some files dealing with them were missing. From the files examined it was found that Gilmour had tendered for work on 78 occasions and on 32 he was the sole tenderer. In all but 13 of the 78 cases there was nothing to show when the tenders were received. In ten cases out of 46 when there were other offers Gilmour's were accepted in spite of the fact that he was late with his tenders or his prices were higher.

It was found that Gilmour had been able to obtain a copy of the Metropolitan-Vickers Co.'s twelve-month painting programme—a "highly confidential" document. From October, 1954, Gilmour had been sole tenderer for painting contracts at the works. Counsel said that between 1952 and 1955 Gilmour's firm had received contracts worth over £279,000 from the Metropolitan-Vickers Co.

Mr. J. W. Potter, assistant secretary to the Metropolitan-Vickers Co., gave evidence relating to the examination of files from the purchasing department and identified certain documents relating to contracts produced by the prosecution.

Mr. H. Adams, senior clerk in the purchasing department, said that Gilmours had a reputation for speed and first-class workmanship. It was not always the lowest tender that was accepted; these qualities entered into the consideration.

Mr. L. Frampton, a former secretary and director of Gilmours, had come by air from Canada to give evidence on behalf of Gilmour but was not called.

Evidence for the prosecution was given by Mr. I. B. Lomax, director of Lomax Bros., Ltd., Eccles, who did painting work for Metropolitan-Vickers. He said that about 1952 he found that his company was losing a number of contracts and said that he had spoken to Cyril Smith about it.

Mr. W. Rothwell, a former manager with Gilmours, alleged that Gilmour had told him that he had Arthur Smith "in the palm of his hand."

A police sergeant agreed with Mr. R. David, who defended Gilmour, that the latter was a generous man. A detective inspector also said that Gilmour had admitted to him that he had been "too generous" but not guilty of corruption.

Panama Frequency Conversion

The Panama Canal Company has authorised an expenditure of $(U.S.)3,800,000 on the conversion of the Canal locks to 60 c/s. Proposals for the work are to be invited this month and tenders opened in March. In addition Pacific area conversion to 60 c/s will cost $2,000,000; Madden hydro-electric plant conversion, $700,000; Summit substation conversion, $300,000; replacement of pumps and switchgear at Mount Hope substation, $128,900; remote control and relay system, $600,000; and design for the replacement of the Miraflores substation switchgear $30,000. Inquiries should be addressed to Colonel H. Arnold, Engineering and Construction Division, 318, Administration Building, Balboa Heights, Canal Zone. Responding firms are asked to notify the Commercial Section, British Embassy, Box D, Ancon Post Office, Canal Zone, Panama, of any action taken.

Parliamentary Report

IN the House of Commons last week Mr. Beswick asked the Lord Privy Seal if he would now review, in the light of the nation's fuel requirements, the allocation of manufactured nuclear material as between the civil and military programmes.

Mr. R. A. Butler said that the type of nuclear power station to be built in the early years of the nuclear power programme used natural uranium and the Atomic Energy Authority did not expect any shortage of this fuel. The timing of the introduction of more advanced reactor types would be determined by the progress of research and development.

Trade Fairs

In reply to Mr. Bottomley, the President of the Board of Trade (Mr. Peter Thorneycroft) said that the Exhibitions Advisory Committee, which had been reconstituted under the chairmanship of Mr. Low, Minister of State, was examining various aspects of policy on overseas trade fairs and he awaited their views before deciding on any changes that might be desirable.

Hire-Purchase Deposits

Mr. Thorneycroft informed Mrs. Jean Mann that he proposed to lay before the House shortly Orders dealing with loans made by arrangement with dealers for the payment of hire-purchase deposits and advance rentals.

Transferable Pension Schemes

Sir Frank Medlicott asked the Minister of Labour what investigation was being made by or through his department into the possibility of interchangeability between superannuation schemes, so that as far as practicable employees could carry with them into fresh employment the benefits of accrued superannuation contributions previously paid.

Mr. Iain Macleod said that this matter was of general interest and arrangements were being made to collect information about existing occupational pension schemes, including the number of workers they covered.

Mr. Frederick Lee asked the Minister whether he would discuss with the National Joint Advisory Council the possibility of adapting to the general industrial pension schemes, the transfer principle agreed upon by the Engineers' Guild.

Mr. Macleod said he had seen brief statements in the Press about a pension scheme which had been drawn up by the Engineers' Guild for its professional members and he was making further inquiries about it.

Electricity Bill Debate

The debate on the second reading of the Electricity Bill took place on Monday. Christmas publishing arrangements make it necessary to hold over the report of the proceedings until next week.

Nuclear Power Programme

The Minister of Fuel and Power (Mr. Aubrey Jones) announced on Monday that his promised statement on the nuclear power programme would not be made until after the Christmas recess as he had not finished his examination of all the problems concerned.

NEW BOOKS

Radio and Electronic Components. Vol. III. Fixed Capacitors. By G. W. A. Dummer, M.B.E., M.I.E.E. Pp. 260; figs. Sir Isaac Pitman & Sons, Ltd., Pitman House, Parker Street, Kingsway, London, W.C.2. Price 45s.

It is a curious fact that, although the electronic and allied industries absorb millions of fixed and variable resistors and capacitors each year, the vast bulk of published information on components has been confined to the characteristics of the specialised types such as standard and sub-standard. The circuit designer has, consequently, to acquire a knowledge of the "commercial" type of component, with which he is mainly concerned, from a study of manufacturers' leaflets and personal experience. This is not a very satisfactory state of affairs, because although the properties of similar components produced by different manufacturers may differ slightly due to variations in manufacturing technique, etc., the basic properties of various components can be classified to a considerable extent.

The present work, which is one of a series of four volumes relating to components, comprises a summary of general information relating to capacitors, followed by a relatively detailed discussion of the constructional features and performance of individual types, classified according to the nature of the dielectric material. A useful list of references to the relevant British, American and Canadian specifications on dielectrics and capacitors is included, together with details of the numerous systems of colour coding which have been devised by the various authorities.

The basic methods of measuring the electrical properties of fixed capacitors, e.g. temperature coefficient, loss angle, etc., are briefly outlined, and a large section of the book is devoted to the electrical, mechanical and "climatic" specifications of a typical range of capacitors produced by a variety of manufacturers.

A comprehensive bibliography is included covering the development of dielectric materials, capacitors and measuring techniques. In the writer's opinion, the book will be of value both to the graduate engineer, as a guide to the limitations of the various types of capacitor, and the circuit designer, as a reference work to aid in the selection of capacitors for given applications.—H.B.W.

Frequency Modulation Engineering. By C. E. Tibbs and G. G. Johnstone. Pp. 435; figs. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 45s.

This is the second edition of the book with the same name, written by the senior author and published in 1947. The co-author, who is mainly responsible for the revised edition, is a member of the B.B.C. Engineering Training Department, which gives the book an authoritative air.

The book begins with a careful mathematical discussion of amplitude, phase and frequency modulation. Two chapters are devoted to interference, noise and their suppression. The next two chapters deal with propagation and aerial systems respectively. Transmitters are next discussed in a chapter which concludes with a detailed description of three existing types of transmitter: an R.C.A. 3 kW transmitter, a Marconi 10 kW and a Link 50 W set. Limiters and discriminators are next described, followed by a chapter on receivers. The last two chapters are on measurements and on the applications of F.M. in commercial radio. The book is well illustrated with plenty of clear diagrams and oscillograms showing the waveforms obtained in the circuits under discussion.

I must confess that I find the arrangement of the book somewhat eccentric. I think that students would find it easier if the general introduction and basic material on the modulation process were immediately followed by the descriptions of the "hardware." The more complicated aspects of noise and interference could follow and the remainder of the material should constitute the tail of the book. As regards the material itself one can offer no criticisms except of the chapter on receivers which ought to include descriptions of present British domestic designs instead of U.S. designs, in which no particular attention is paid to quality of reproduction.

The book should prove even more useful than the original edition.—A.H.W.B.

Kempe's Engineer's Year Book (1957). Edited by C. E. Procter, M.I.E.E., M.I.Mech.E., under the direction of B. W. Pendred, M.I.Mech.E., M.I.S.I. 2 Vols. Pp. 2,740; illus.; index to over 17,000 references. Morgan Bros. (Publishers), Ltd., 28, Essex Street, Strand, London, W.C.2. Price (2 vols. in case) 82s 6d.

The 62nd edition of this handbook has had the usual annual revision required to keep its manifold subjects in line with recent progress. From the electrical angle the most noticeable alterations are found in the further details given concerning atomic power and in the enlargement of the sections dealing with electric traction and diesel locomotives. The value of the information on water turbines has been enhanced by the inclusion of pump turbines and the new Deriaz or feathering Francis machine. Among general engineering features the biggest change is a newly written chapter on gearing.—C.O.B.

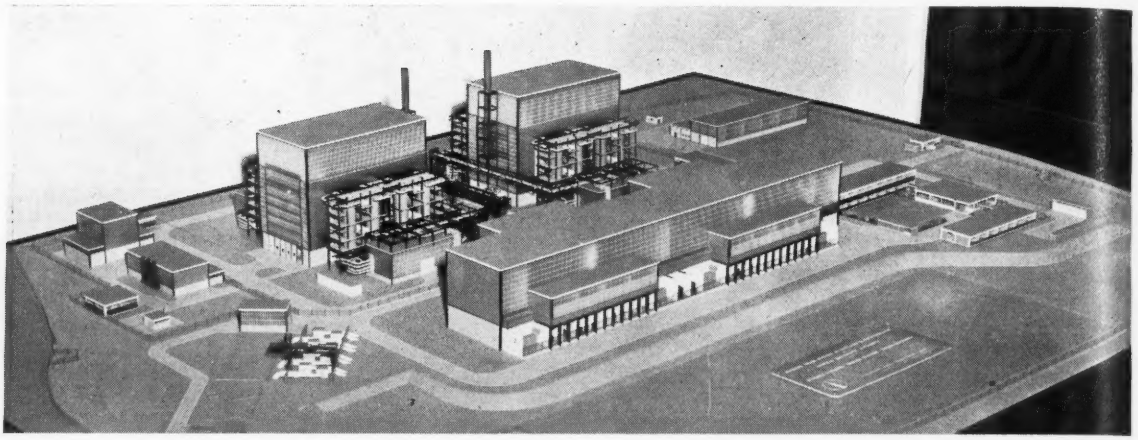
Christmas Lectures

THIS year's I.E.E. Christmas lecture for older schoolchildren is to be given in the Lecture Theatre at 3 p.m. on Tuesday, 1st January, and repeated on the following afternoon at the same time. The subject will be "The Evolution of Automation," the lecturer being Mr. J. F. Coales, O.B.E., M.A., M.I.E.E., of the Engineering Laboratory, Cambridge University. The lecture, the eleventh to be organised by the I.E.E., will be illustrated with slides and demonstrations. Admission is free. Application for tickets, stating for which afternoon they are required, should be made to the secretary of the Institution.

The North Western Centre of the I.E.E. is holding a Christmas lecture for schoolchildren on 28th December (3 p.m.) at the College of Science and Technology, Manchester, when Dr. J. C. West will speak on "Automatic Control in Industry." The lecture will be repeated on 31st December (3 p.m.) at the Royal Technical College, Salford.

Among the Christmas holiday lectures for secondary school pupils organised by the London County Council is one on "Lamps and Lighting" by Mr. E. B. Sawyer, manager of the Lighting Service Bureau. It will be given on 2nd January at the Bureau and will deal with the production of light by electricity, the uses of lighting for production and greater safety, and light and colour.

At the Albert Stern Hall, Queen Mary College, on 31st December, Dr. R. F. Saxe will talk on "Nuclear Power"; and at the Northampton Polytechnic on 3rd January Mr. R. S. Medlock will deal with "Automation."



This is a photograph of a model of the projected nuclear power station which the English Electric Co., Ltd., submitted with its tender to the Central Electricity Authority

ATOMIC DEVELOPMENTS

WE have already mentioned that a fifth British atomic group was being formed, after consultation with the United Kingdom Atomic Energy Authority and the Central Electricity Authority, to tender for the design and supply of atomic power stations for the United Kingdom and abroad.

The companies which have formed this new group and their respective interests in the design and construction of the power stations, are Richardsons, Westgarth & Co., Ltd., suppliers of the generating plant including the turbo-alternators, blowers and standby generators; International Combustion (Holdings), Ltd., who will undertake the building of the steam generating equipment, including the reactor, heat exchangers and pressure vessels; and Crompton Parkinson, Ltd., who will manufacture the switchgear, transformers, cables and motors.

A team of technical experts, made up of design engineers, nuclear physicists, metallurgists, etc., has been formed for the new group's development and research activities. The nucleus of this team has been established by bringing together the technical personnel who have already been engaged on nuclear work within the member companies, and further people are being recruited.

The group will operate through a joint company, Atomic Power Constructions, Ltd., with an authorised capital of £1,000,000. The board consists of Lord Coleraine, P.C., as chairman; Mr. Harry Fothergill, a director of Richardsons, Westgarth & Co., Ltd.; Mr. J. Mayer, joint managing director of International Combustion (Holdings), Ltd.; and Mr. J. V. Daniel, managing director of Crompton Parkinson, Ltd.

The new organisation will be accommodated centrally in an office block recently constructed at 28-30, Theobalds Road, London, W.C.1. The whole of that building has been taken over by the group.

The second reactor at the Calder Hall nuclear generating station of the United Kingdom Atomic Energy Authority has now started working. This means that a sufficient quantity of the uranium fuel on which it operates has been loaded to ensure a self-sustaining chain reaction. Loading will still be continued to reach the quantity necessary for maximum power production, and a considerable programme of technical testing and of experimental work will have to be carried out before the reactor is finally commissioned. Early in the New Year this second reactor should be feeding power into the grid. When both reactors of the first Calder Hall power station are operating at full power, they will have an installed capacity of 92 MW, of which about 70 MW will be fed into the grid.

Another power station of the same capacity is under construction at Calder Hall, and should start operating in 1958. It is being built by the U.K. Atomic Energy Authority whose programme also includes a similar station with four reactors at Annan in Dumfriesshire, Scotland, due to start working in 1959, and a fast breeder reactor at Dounreay in the north of Scotland, which will come into operation in 1958. All these stations are entirely separate from the programme being undertaken by the Central Electricity Authority and the South of Scotland Electricity Board.

Nuclear Energy Course

NEW opportunities for industry to acquire basic knowledge of nuclear energy are offered by a special course which has been arranged at the Harwell Reactor School of the United Kingdom Atomic Energy Authority.

The standard reactor school course is one of 14 weeks' duration giving instruction primarily in reactor physics and engineering. Present arrangements enable some students to attend only the first six weeks of this course, during which time the basic principles of these subjects are taught, but the numbers of these students have had to be limited because the demand for places has been high.

From 3rd June to 12th July, 1957, a special six weeks' course is to be run entirely separately, and some sixty places will be available. Besides covering the basic principles of the physics and engineering of reactors, lectures will be given on such subjects as reactor metallurgy, shielding and health physics. In addition, emphasis will be placed on special topics such as the instrumentation of reactors and the use of radio-isotopes in industry. The latter topic is not included in the standard reactor school course.

This special course is designed primarily for people of degree standard who are not directly concerned with overall reactor design. It should appeal especially to members of firms whose interest lies in the making of ancillary equipment for reactors.

Application forms for places may be had on request from the Reactor School, Atomic Energy Research Establishment, Harwell, Berkshire. The students who are to participate will be selected at the beginning of March, 1957.

INDUSTRIAL NEWS

High-Voltage Bushings

The latest edition of B.S. 223, "High-Voltage Bushings," which supersedes the original edition issued in 1931, now applies to bushings for indoor and outdoor use on three-phase systems with rated voltages in the range of 3·3 kV to 275 kV. It is intended to cover only bushings which can be tested separately without affecting their electrical performance and, although it can apply to bushings in cable boxes, cable sealing ends are excluded.

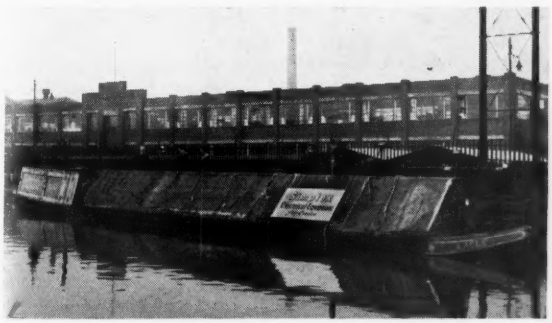
Major changes have been made throughout the specification, and in particular to the sections dealing with rating and testing. The system of rating numbers used in the 1931 edition has been discontinued and standard bushings are now rated in terms of service voltage, nominal current, frequency and insulation level. The section dealing with the tests has been extensively altered to bring it into line with present practice. Two impulse-voltage tests have now been introduced as type tests. The first test is intended to prove the full-wave withstand voltage and the second the under-oil flashover or puncture withstand levels.

The selection of standard bushings in terms of the characteristics of the system and the installation and service conditions is dealt with in an appendix. Other appendices include test voltage corrections for atmospheric conditions, information concerning power factor testing and a summary of the information required with an inquiry or order.

Copies of B.S. 223 : 1956 (7s 6d) may be obtained from the British Standards Institution, 2, Park Street, W.1.

Beating the Petrol Shortage

On 10th December the first of a fleet of narrow boats left the wharf side of the Simplex Works at Oldbury on her "maiden voyage" to the company's new London depot which was recently opened at Alperton, Middlesex. It is anticipated that up to 80 tons of electrical equipment per week, including not only the industrial products manufactured at Oldbury but also domestic products from Creda Works, Blythe Bridge, will be transported to London by this method.



Boat load of electrical equipment ready for transport by canal to the Simplex London depot

Power Convention Exhibition

The exhibition which is being held in conjunction with the British Electrical Power Convention at Eastbourne from 17th to 21st June will be organised by the Electrical Development Association, 2, Savoy Hill, London, W.C.2. The hard courts in Devonshire Park are again to be made available for this event and stand spaces will average some 110 sq ft in size. Applications for space should be made direct to Mr. V. W. Dale, Comp.I.E.E., director and secretary, E.D.A., not later than 31st December.

Irish Productivity Exhibition

An "Electricity and Productivity" Conference and Exhibition is being organised by the Irish Electricity Supply Board to take place in the Main Hall of the R.D.S. Showgrounds, Ballsbridge, Dublin, from 18th to 22nd February next. The speakers will include Messrs. L. Landon Goodman of E.D.A., A. C. Cooper (national handling techniques), M. O'C. Horgan (high frequency heating), R. S. Evans (pH control of aqueous solutions in industry), M. Lemercier (infra-red heating), and F. X. Algar, head of the E.S.B.'s Lighting Service Bureau.

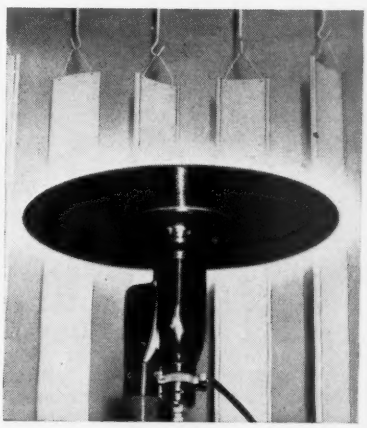
Improved Finish for Fluorescent Fittings

In order to obtain still finer control of enamel finishing on their "New-Range" fluorescent lighting fittings, and to ensure regularity of thickness and coverage of all edges, internal and external corners and return surfaces, Crompton Parkinson, Ltd., have recently installed the Ransburg reciprocating spinning disc system of electrostatic spraying at their Doncaster works.

With this method the enamel is introduced at the centre of a fast spinning disc which reciprocates vertically to the full length of the article to be covered. The enamel is electrostatically charged to 90,000 V and the metal parts of the fittings, including all bonderised diecastings, as well as bonderised steel parts, travel and turn in a plane around the disc. The articles, of course, are at earth potential, so that the electrostatic forces present ensure that all parts attract the atomised, charged particles of enamel and cause them to adhere with the greatest possible tenacity.

Although widely used in the United States for high quality continuous production, the system installed at Doncaster is believed to be the first of its type to operate in Europe. It has now been in use for some time, and, as a result, the "Permawhite" finish of the company's "New-Range" fluorescent lighting fittings has been further improved.

Apart from the closer control which the new system provides, the success of the "Permawhite" finish is due to the methods of preparation and pre-treatment of the metal, the complete absence of loosely adhering particles of foreign matter, and the fine control of enamel quality and mixing. In addition, the consistency of coverage given by the various coats and the successive efficient stovings including prolonged curing given to the coats, ensures good opacity and reflectivity with high gloss and endurance.



Electrostatic spraying head at the Crompton Parkinson works

Release of Atomic Information

A comprehensive extension of the information on atomic energy which may be freed from security restrictions has been agreed upon by the United Kingdom, the United States and Canada. As a result of this a considerable volume of material to assist the peaceful development of atomic energy will become available as reports, drawings and other material are reviewed and declassified. British industrial organisations engaged on the nation's ambitious nuclear power programme will find the new classes of information particularly valuable. As an example, although many of the

details concerning the Calder Hall type of reactor have been published some aspects could be obtained only under certain security restrictions involving limitations on those engaged in the work. Acquisition of information not only of this type but of reactors under consideration for the future is now freed from security restrictions.

Aspects of nuclear power covered by the guide embrace ore recovery and fabrication of fuel elements and the design and operation of plants for chemical recycling of spent fuel from civilian power reactors. It will now be possible to release for the first time detailed production figures of uranium ores and concentrates.

North American Uranium Resources

One result of the "declassification" of certain information on nuclear energy matters has been a statement on Canadian and United States uranium sources and production. Ore reserves so far known in Canada are put at about 225 million tons and the annual production of high-grade concentrate is 3,300 tons. It is anticipated that production will be rapidly accelerated to 14,000 or 15,000 tons a year by the middle of 1958.

United States ore reserves (largely in New Mexico) are estimated to be 60 million tons and the annual production of uranium oxide is over 8,000 tons.

Electricity in National Parks

The National Parks Commission, in its annual report, states that it is "deeply concerned at the growing demands from many quarters for the use of sites in National Parks and other areas for projects which threaten to despoil our countryside." Reporting upon action which it has taken to resist what, in its judgment, would be developments damaging to the landscape, the Commission refers particularly to the "problem of reconciling the claims of landscape beauty with the pressing need to provide an electricity supply in rural areas as economically as possible."

The report refers to the negotiations with the North Western Electricity Board about the way in which electricity should be supplied to Great Langdale in the Lake District National Park, where in the Commission's view the supply line should be placed underground in order to avoid damage to the landscape beauty of the area. It has asked the Minister of Fuel and Power to say in this case that none of the proposed line should be placed overhead.

Mrs. A. Hobbs (Liskeard) and Miss C. Clark (Bedford) second and third prize-winners respectively of the country cook competition at the recent National Poultry Show, Olympia. Both ladies used a "Creda Carefree" electric cooker

Mr. A. Goude (A.E.I. Lamp & Lighting Co., Ltd.) congratulating Miss June Dawson, of Ellesmere Port, the winner of the Mazda "Queen of Light" Competition, the final of which was held recently at the Lyceum, London

Lamp Price Revisions

With effect from 4th December "Atlas" 150 W spotlight and floodlight reflector lamps of Thorn Electrical Industries, Ltd., have been reduced to 10s 6d.

Thorn Electrical Industries also announce revisions of the list prices of certain types of "Atlas" special lamps as from 15th December. The types affected include projector and photographic lamps, low voltage g.l.s. types, pigmy sign, coloured and colour sprayed lamps and frosted candle lamps. New prices for lamps with non-standard caps are also being introduced.

Geared Turbo-Generator Exports

The Metropolitan-Vickers Electrical Co., Ltd., is supplying geared steam turbo-generator sets with an aggregate capacity of over 30,000 kW to Eire, the Middle East, Africa and India. An order recently obtained from the Indian State of Rajasthan covered eight 1,000 kW self-contained condensing sets, valued at more than £200,000; these are to be installed in pairs in four power stations in the area of the Chambal hydro-electric project.

Since the beginning of 1956 32 geared turbo-generator sets, ranging from 350 kW to 5,000 kW, have been ordered from Metropolitan-Vickers; the overall aggregate capacity is 36,700 kW, and the total value exceeds £750,000.

Accountants' Conference

Some 70 members of the accountancy staff of the East Midlands Electricity Board attended a conference at The Hayes, Swanwick, Derbyshire, from 3rd to 5th December, under the chairmanship of the chief accountant of the Board, Mr. C. W. Flint, A.C.A. The theme of the conference was management accounting and papers representing the engineering and managerial points of view were given by Mr. A. E. Strong, M.I.E.E., chief assistant engineer, and by Mr. J. P. Tucker, M.I.E.E., manager of the Lincolnshire Sub-Area. The final paper was given by Mr. E. Sinnott, F.I.M.T.A., chief accountant, South Eastern Electricity Board and this year's president of the Incorporated Municipal Treasurers' Association.

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Monday last.

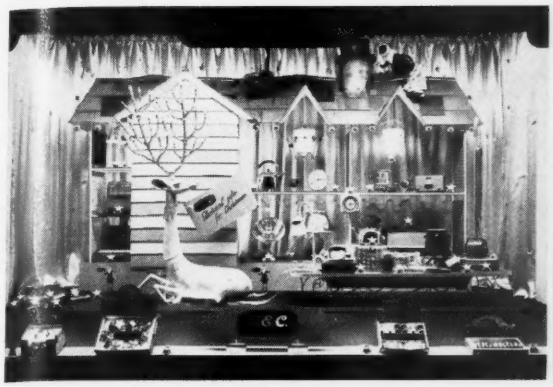
ALUMINIUM ingots	ton £197 0s 0d
COPPER, H.C. Electro	ton £274 0s 0d
Fire Refined 99·7%	ton £273 0s 0d
Fire Refined 99·50%	ton £272 0s 0d
COPPER Tubes ..	lb 2s 7½d
Sheet	ton £345 10s 0d
H.C. wire and strip ..	ton £309 0s 0d
LEAD, English ..	ton £114 15s 0d
Foreign	ton £113 0s 0d
MERCURY	flask £84 0s 0d
TIN, block (English) ..	ton £807 0s 0d
ZINC, G.O.B. Foreign	ton £101 0s 0d
Electrolytic	ton —
BRASS Tubes (solid drawn)	lb 2s 2d
Sheet	ton —
Wire	lb 2s 10½d
PHOSPHOR BRONZE Wire	lb 4s 3⅝d
PLATINUM	oz £34 0s 0d
RUBBER, No. 1 R.S.S. spot	lb 33½d—33⅝d

Mobile V.H.F. Radio for Metropolitan Police

The Metropolitan Police have placed an order with Marconi's Wireless Telegraph Co., Ltd., for the supply of fifty of the new Marconi 10 W f.m. mobile transmitter/receivers, Type HP81B.

Electricity in Steel Works

In an illustrated brochure reporting on the company's organisation and work Dorman, Long & Co., Ltd., show that since 1939 there has been a striking increase in the amount of electric power used per employee. In 1939 the company's iron and steel



Further examples of festive displays. Left: G.E.C. window display at Magnet House, London. Right: One of the two new factories of Dimplex, Ltd., at Millbrook, Southampton. Below right: Decorative lanterns at the Promenade, Cheltenham

works used about 206 million kWh, equivalent to 15,794 kWh per man employed. Last year the works used nearly 317 million kWh, or 22,009 kWh a head, an increase of 39·5 per cent. There has been a consequent rise in the output of steel ingots per man employed. It is pointed out that in addition to electrical aids the worker has several forms of mechanical handling aids placed at his disposal.

E.D.A. Annual Luncheon

The annual luncheon of the British Electrical Development Association will be held at the Savoy Hotel, London, on 7th May next. The annual general meeting of the Association will be held after the luncheon.

Telecommunications Equipment for the Azores

Marconi's Wireless Telegraph Co., Ltd., has been awarded another substantial contract by the Portuguese Postal and Telegraph Authorities for the provision of radio-telephone communication equipment. The order is for four duplicated v.h.f. multi-channel terminal units, type HM.100, and ancillary equipment. This will be used to establish direct telephonic communication between the islands of San Miguel and Terceira, and between Terceira and Faial, in the Azores group. Initially, the links will carry seven speech channels and six voice-frequency telegraph channels; standby equipment will come automatically into operation in the event of breakdown of any transmitter, receiver or power supply.

Marine Radar Installations

Decca Radar, Ltd., announce that the total number of ships for which their equipment has been ordered now exceeds 6,000, an increase of over 1,000 since April last. Since the company's new true motion radar, TM.46, was introduced to shipowners on 24th October last it has been ordered for fitting to more than 100 vessels which vary from passenger liners to cargo liners and tramps. These orders have been placed by shipowners in the United Kingdom, Norway, Sweden, Denmark, Holland, Germany and France.

N.A.T.O. Delegates Visit Valve Works

Members of the North Atlantic Treaty Organisation Valve Standardisation Group recently visited the Hammersmith Works of the M.O. Valve Co., Ltd. The function of this group, which has delegates from each of the treaty countries, is to recommend the adoption of specific valves as preferred types in order to standardise the electronic equipment used by the forces of N.A.T.O. members.

They were shown a range of G.E.C. special valves and the manufacturing and test facilities of the M.O. Valve Co., which is now a wholly owned subsidiary of the General Electric Co., Ltd.

Ferranti-Ekco Link

Ferranti, Ltd., and E. K. Cole, Ltd., have issued a joint statement announcing that arrangements have been made for E. K. Cole, Ltd., to take over the marketing of domestic radio and television receivers under the "Ferranti" trade mark. A new company is to be formed and Ekco will make an early announcement to Ferranti dealers with regard to future plans. In the meantime, deliveries of the current range of receivers will continue.

Useful Suggestions Rewarded

In a factory suggestion competition run by the *News Chronicle* three employees of the South Eastern Electricity Board reached the final and won prizes. The employees and their ideas were:—Mr. D. E. Kent, electrician, Bexhill-on-Sea, device for re-threading beads on electric cooker boiling plates; Mr. A. D. Leaney, h.v. jointer, Haywards Heath, safety saw for cutting aluminium conductors; and Mr. L. Robson, chargehand, Purley, electrically heated knife for cutting bituminous compound. Before the suggestions were entered Seeboard had paid each employee an initial award of five guineas. They may get more from the Board if their ideas are widely adopted and may also win a national prize under the National Joint Advisory Council's scheme for pooling ideas in the electricity supply industry.

Cooking Demonstration at Speech Day

At the speech day of the Hastings and St. Leonards Technical College on 3rd December a demonstration was given by the Catering Department of the College, a meal being cooked and served on the stage of the White Rock Pavilion, Hastings, by the students of the College. The equipment used for cooking the meal was all-electric and was lent by the South Eastern Electricity Board for the evening.

Dock Improvement Schemes

The British Transport Commission has approved additional port facilities costing £1,365,000 at Newport and Barry Docks, South Wales. At Newport a new transit shed at the South Quay will be equipped with two overhead gantry cranes, and mobile cranes, fork-lift trucks, and electric trucks will be provided. Twenty electric level luffing quay cranes, of 6 tons lifting

capacity, with a working radius of 70ft, will be installed. The North Quay hydraulic cranes are to be replaced by electric cranes displaced from the South Quay. A transit shed equipped with mobile mechanical cargo-handling equipment will be constructed.

At Barry a new berth will be equipped with five electric quay cranes of 10 tons lifting capacity and specially designed for grab work.

Copper Development Association

The Copper Development Association, whose headquarters have been at Kendals Hall, Radlett, Herts., since the end of the war, has returned to London to new premises at 55, South Audley Street, W.1 (telephone: Grosvenor 8811).

Domestic Electrical Equipment in East Africa

A G.E.C. domestic equipment demonstration team has just returned to this country after touring Uganda, Kenya, Tanganyika and Zanzibar. The tour has been carried out with the co-operation of the company's agents, Gailey & Roberts, Ltd., in Uganda, Kenya and Tanganyika and M. D. Kermalli in Zanzibar. It was supported by the Uganda Electricity Board, the East African Power & Lighting Co., Ltd., Tanganyika Electricity Supply Co., Ltd., Dar es Salaam & District Electric Supply Co., Ltd., and the Public Works and Electricity Department, Zanzibar. The Education Departments and private girls' schools also supported the tour.

The highlight of the tour was the continuous demonstrations at the Royal Show in Nairobi on the occasion of the visit of Princess Margaret. These demonstrations were held on the stand of the East African Power & Lighting Co., Ltd., which was specially designed for the purpose. Mr. Colin Hopton, of the Cardiff Branch of the G.E.C., has been in charge of the team, and was accompanied by two fully qualified demonstrators, Miss Zena Skinner (London) and Miss Anna MacDougall (Scotland). The team carried out a variety of demonstrations to suit the needs of all communities, including both Western, African and Eastern styles of cooking, the use of G.E.C. refrigerators, washing machines and rotary ironers, as well as small appliances such as vacuum cleaners and floor polishers. Special demonstrations were given to schoolgirls of all communities and to African cooks. Emphasis was given to the economic use of electric cookers.

Samburu warriors try for themselves delicacies cooked by the Misses Zena Skinner and Anna MacDougall on a G.E.C. kwali table cooker

Young Farmers' Clubs Competition

The South Western Electricity Board is holding the third of its series of Young Farmers' Clubs competitions. Teams of young men and women from all over the West Country will be competing and showing their knowledge of the best use of electricity on the farm and in the home by answering questions before an audience. Teams will consist of four members, two girls and two boys (not under 16 years of age). Each team member will be asked five questions. The area final will be held on 11th April next at the Imperial Hotel, Exeter.

Calendars and Diaries

Once again the calendar from C. A. Parsons & Co., Ltd., consists of monthly sheets bearing photographic views in colour of some of the scenic beauty of Great Britain.

A painting by George Ayling of a corner of York, with the Minster towers in the background, is reproduced on the 1957 calendar of Courtney, Pope (Electrical), Ltd.

Marconi Instruments, Ltd., has sent us a desk diary nicely bound in dark red leatherette.

An engagements calendar with weekly slips has been received from Edwards High Vacuum, Ltd.

The pocket diary received from the British Vacuum Cleaner & Engineering Co., Ltd., is bound in maroon leatherette and includes a great deal of useful technical data.

The calendar of the Midland Electric Manufacturing Co., Ltd., has monthly slips mounted on a card with a view of an English castle.

Each of the large monthly sheets of the calendar of Danfoss, Denmark, has a colourful picture of the shores of Denmark.

"Gypsies in the Rosses, County Donegal," a reproduction from an oil painting by Frank McKelvey, R.H.A., makes an excellent picture for the calendar received from Davidson & Co., Ltd., which has monthly sheets showing also the preceding and following months.

The Irish Minister of Industry and Commerce, Mr. W. H. Norton, recently visited the General Electric Co.'s Atomic Energy Department at Erith, Kent. The photograph shows Mr. R. N. Millar (right), manager of the Atomic Energy Department, explaining the details of cans for uranium fuel elements to the Minister (centre), and Mr. M. F. McCourt (Irish Electricity, Ltd.)

The London Electricity Board has sent us a neat pocket diary, bound in maroon leather, which, in addition to the usual diary information, contains particulars of the administrative staff of the Board, area organisation, etc.

Trade Announcements

Truvox, Ltd., has appointed Mr. J. A. Reid, 18, Hyndland Road, Glasgow, W.2 (telephone: Glasgow Western 3193), to cover Scotland, and Mr. P. Witkin, 125, Oxborne Road, Newcastle-on-Tyne, 2 (telephone: Newcastle 810541), to cover Cumberland, Durham, Northumberland, Westmorland and Middlesbrough. Both will handle industrial floor treatment machines and domestic polishers.

Heyes & Co., Ltd., Wigan, has opened a sales depot at 23, Bedford Street, Belfast. Mr. J. Ballentine will supervise representation and distribution throughout Ireland. The company is opening similar offices throughout the British Isles.

Slough Metals, Ltd., have appointed F. R. Warren & Co., 27, St. Nicholas Street, Bristol (telephone: Bristol 2-8493), as their technical representatives for the West Country.

Hedin, Ltd., South Woodford, have appointed James R. Turner & Co., of 593, Nitshill Road, Glasgow, S.W.3, as sole agents in Scotland for their ovens, furnaces and heating equipment generally.

The Exeter depot of **Wessex Wholesale Electric, Ltd.,** is now at 25, Mary Arches Street, Exeter.

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Private Generating Plant

I READ with interest Mr. Ellison's article on the technical aspects of supply by private generating plant to the public system, and the subsequent correspondence initiated by Mr. Laidlaw.

Mr. Ellison writes "There are no technical difficulties .... There are obvious difficulties in arriving at a tariff .... However, the Central Electricity Authority have expressed a willingness to do all they can to conserve the nation's fuel resources, and it will be interesting to see whether the North of Scotland Board has the same policy." Mr. Laidlaw is not wholly reassuring when he replies, writing of a letter he has received, "While in all respects essentially non-committal, its general tone suggests not so much a body able and willing to help those within its area (the declared aim of the Hydro-Electric Board) as a commercial firm anxious to sell but reluctant to buy."

The Herbert Committee's Report quotes an estimate that there was, at the time of the Report, 4½ million kW of private generating plant in the country against 19 million kW of public generating capacity. The private plant is equal to nearly 25 per cent of the public, and yet the former contributes less than 0·5 per cent of the output of the latter to the grid system, according to the Report's figures. Further figures are given which show that private plant has an average load factor of just over 30 per cent (46·8 per cent is quoted for the public supply). From this it would seem a fair estimate that 25 per cent of the capacity, or over 1 million kW, is unused and available at any moment, and in particular at peak periods.

Now it is almost axiomatic that private generation is undertaken where the economic circumstances are favourable and the Herbert Report comments more approvingly than otherwise on its efficiency.

We have applauded the technical triumphs of Calder Hall, but we have been rather quiet on the point that at any moment we probably have unused and available more capacity, in private hands, than Calder Hall will ever have.

We have heard much of the need for capital expenditure cuts. We have been rather quiet on the probability that we could forgo the equivalent of a whole year of the expenditure needed to increase the generating capacity of the public system if arrangements could only be made to receive supply from already available private generating plant capacity.

One may assume that those in the public supply industry are both patriotic and that they wish to help. One may also assume that those in private industry who generate electricity are equally patriotic and wish to be of service to others. Why then does a chasm apparently exist? I suggest that the need to encourage and to attract private supply to the maximum possible extent was not foreseen at the passing of the Electricity Act, 1947, nor at the passing of the Hydro-Electric Development (Scotland) Act, 1943. I further suggest that, as a consequence, there are administrative difficulties, which ought not to exist, that have had and are having a damaging effect on the economy of the country, and should be removed.

D. MAITLAND MAKGILL CRICHTON.

Crieff, Perthshire

Underground Gasification

THE team of experts working on underground gasification, the project for increasing Britain's fuel supplies by igniting unmineable coal seams to obtain gas, described fully in the *Electrical Review* of 18th November, 1955, is to be greatly increased, and operations will be stepped up rapidly. This follows the recent appointment by the National Coal Board of a company to develop the scheme at Newman Spinney, near Chesterfield. The main contract has been awarded to Humphreys & Glasgow, Ltd., a firm of international repute in the fuel and chemical industries. They will develop the necessary scientific and engineering techniques, and construct a pilot plant to provide gas for a small electric generating station to be installed by the Central Electricity Authority. They will also prepare designs for the first full-scale commercial plant, to be built if the results of the pilot scheme justify it. As a longer-term objective, the company will seek to develop methods of making composite gas for conversion into a number of products, including oil fuels.

At present there are about 20 technical and other staff at Newman Spinney engaged on the experimental work begun by the Ministry of Fuel and Power and taken over by the N.C.B.

It has been said that there are hundreds of millions of tons of coal in Britain which are unmineable by ordinary means, but which may be exploited by the underground gasification process. At present effort is being concentrated on using the gas to produce electric power, and it is hoped that the cost of using such fuel in power stations will be less than that of oil or nuclear energy. If the pilot plant is successful, a full-scale 60,000 kW power station is likely to be built, and this would use about 1,000 tons of coal a day by underground gasification.

The coal seam chosen at Newman Spinney for gasification is of secondary quality and is not worth mining because of its high ash content.

Some 5,000 tons of coal have already been gasified in a series of experiments conducted by the Ministry of Fuel and Power and the National Coal Board. The most promising techniques, which will be used in the pilot scheme, use horizontal boreholes in the coal for carrying both the gas and the air needed for gasification. In one of the techniques holes are bored in the coal connecting two galleries; in another the holes are blind and they contain a pipe that conveys air and steam to the reaction, and the gas returns outside the pipe.

The N.C.B. has appointed Sir Alexander Gibb & Partners in association with Messrs. Cremer & Brearley to act as its consultants in carrying out the development of underground gasification.

Electrical Review 21 *December* 1956

This is what the Bradwell, Essex, station (Nuclear Power Plant Co.) will look like (Architect, Maurice Bebb)

Nuclear Power Stat

CONTRACTS for their first two nuclear power stations have been awarded by the Central Electricity Authority subject to clearance of outstanding technical and contractual matters. The contracts are for complete power stations in each case. The station at Bradwell, Essex, will be built by the Nuclear Power Plant Co., Ltd., headed by C. A. Parsons & Co., Ltd., and the one at Berkeley, Gloucestershire, by the A.E.I.-John Thompson Nuclear Energy Co., Ltd.

The net output of these stations will be 300 MW and 275 MW, respectively. These increased ratings, compared with the first estimates of some 100-200 MW, will be secured within the site facilities already approved by the Minister of Fuel and Power. Work will commence on site early in the New Year, several months in advance of the time originally contemplated.

Last month the C.E.A. announced that, subject to the requisite planning permission and approval by the Minister of Fuel and Power, they proposed to erect their third nuclear power station in Somerset. They are in negotiation with the English Electric-Babcock & Wilcox-Taylor Woodrow group of companies and, if satisfactory agreement is reached in this respect, they intend to proceed with construction at this site as soon as possible after obtaining planning approval and consent for the project.

The electrical output capacity of the Authority's first three stations will aggregate some 850 MW, and the capital investment will not be less than £120 million.

It is not possible to forecast with certainty either the cost per kW of the Authority's nuclear power stations or, in particular, the price per kWh at which electricity will be delivered from them to the national grid. It is clear, however, that the capital cost will not be less than two-and-a-half to three times that of a comparable coal or oil burning station and that, initially, nuclear generation cost will probably be higher than that from the Authority's advanced types of thermal plant. The hope and expectation is that construction costs of future nuclear power stations will progressively be reduced and that when more experience has been gained on such important factors as the working life of the reactors, the cost and life of the fuel, then nuclear power will become competitive with thermal generation and may even be lower. Without an initial pioneering development, this objective could not be achieved.

In the intensive work that has enabled nuclear power projects to be advanced technically, in capacity and in point of time, the Authority have worked in close collaboration with the Atomic Energy Authority with whom they have a ten-year agreement for services as consultants in respect of matters affecting the reactors. They pay tribute to the manufacturers' design teams.

The three stations to be constructed by the C.E.A. are in addition to the one which the South of Scotland Electricity Board have publicly announced their intention to construct. It will be seen, therefore, that the total capacity of the four stations now envisaged as the first stage of the nuclear power programme will be some four times as great as the total capacity of the two stations which constituted the first stage of the programme set out in the 1955 White Paper (Cmd. 9389).

C.E.A. Berkeley Station

Supplementing the above statement issued by the Central Electricity Authority, the A.E.I.-John Thompson Nuclear Energy Co., Ltd., inform us that they have received the order for the Berkeley (Gloucestershire) station. The station will cost between £30 and £40 million, excluding the " fuel."

The company's engineers and those of its associated civil contractors, Balfour, Beatty & Co., Ltd., and John Laing & Son, Ltd., are ready to start work at once on the site, which is on the estuary of the Severn.

The capacity of the new station, which will be completed in about 3½ years, will be very nearly 300 MW, instead of the 100 to 200 MW put forward in the White Paper programme. This represents a coal saving of between one and two million tons a year.

The station will have two gas-cooled graphite-moderated natural uranium reactors and the heat transfer gas will be circulated through eight parallel circuits, each with its gas circulator and isolating valves. The CO_2 cooling gas will operate at a pressure of 125 lb/sq in. Each reactor with its eight heat exchangers will form a unit in combination with two turbo-alternators. Either unit will be operable independently, and the whole station will be controlled from a central control room.

FIRST THREE CONTRACTS AWARDED

Station Plans

The two reactors, which will be contained in cylindrical pressure vessels about 50ft in diameter and 3in thick, are enlarged and improved versions of those now in operation at Calder Hall. Their net output, however, will be three times that expected from those at Calder Hall. The station has been designed for running continuously and it will be possible to load and unload the fuel elements while the reactors are in operation.

In order to ensure long life for the fuel, the elements will be individually supported and working temperatures have been chosen conservatively. The gas circulators, which are a vital part of the reactor circuit, will be of the axial-flow type, driven by squirrel-cage motors through variable speed couplings. The circulators have been designed by the British Thomson-Houston Co., Ltd., who are also supplying the fuel element control mechanisms, switchgear and transformers.

The heat exchangers, which will be built by the John Thompson Company, will produce superheated steam at two distinct pressures, each bank of eight boilers feeding dual turbo-alternator sets. The steam conditions will be as follows:—H.p. 306 lb/sq in and 612 deg F; l.p. 62 lb/sq in and 612 deg F.

There will be one central turbine hall containing four Metropolitan-Vickers turbo-alternator sets. The turbines will operate at lower steam temperature pressure than is usual in more orthodox power stations. They will be of the horizontal, close-coupled, tandem-compound, mixed-pressure, impulse type.

Other companies within the A.E.I. Group will be supplying equipment to the A.E.I.-John Thompson Nuclear Energy Co. for use in the station, and the experience gained by Sunvic Controls and Isotope Developments, Ltd., will be of great value in the field of instrumentation. Siemens Brothers will provide cable, Ediswan will supply batteries, and Ferguson Pailin switchgear, while Coldrator refrigeration equipment will be supplied by the Hotpoint Electric Appliance Co.

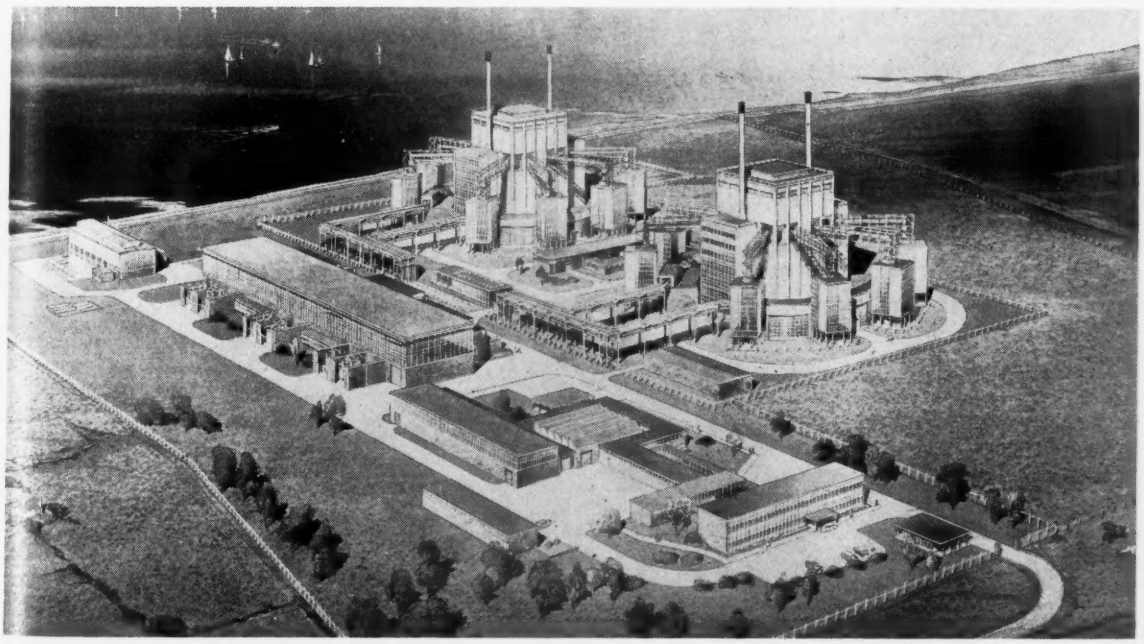
The civil consultants to the A.E.I.-John Thompson Nuclear Energy Company are Messrs. W. S. Atkins & Partners who, with the quantity surveyors, Messrs. Gardiner & Theobald, have senior officials in their organisations who have had considerable experience of United Kingdom Atomic Energy Authority projects.

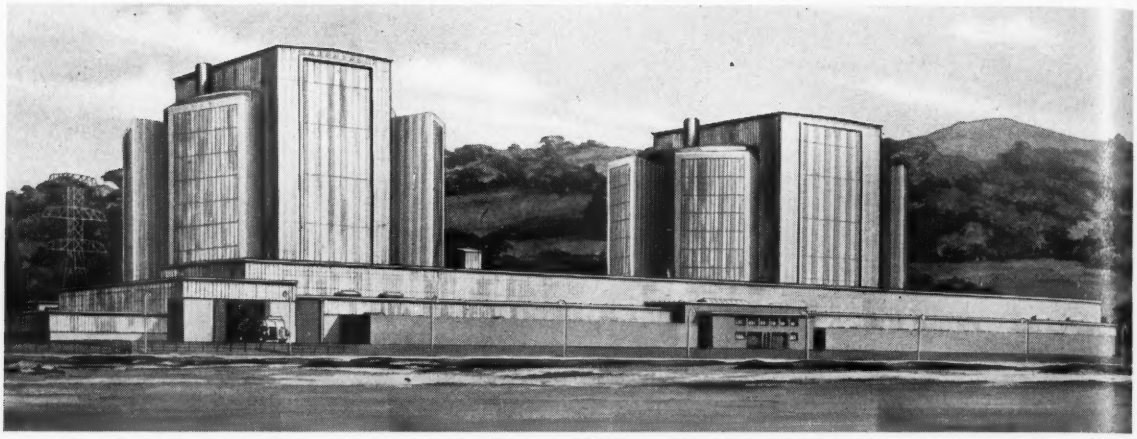
The A.E.I.-John Thompson Nuclear Energy Company has for some time been working closely with Balfour, Beatty & Co., Ltd., and John Laing & Son, Ltd., on this project. John Laing will be responsible for the civil construction work of the reactor and heat exchangers, and Balfour Beatty the turbine house and its associated civil works.

Bradwell Station

The 300 MW station at Bradwell, Essex, to be constructed by the Nuclear Power Plant Co., will have two natural uranium carbon-dioxide cooled graphite-moderated reactors, each with six associated boilers. H.p. steam conditions will be 755 lb/sq in and 704 deg F and the l.p. conditions 195 lb/sq in and 704 deg F. There will be six 52 MW 11·8 kV dual-pressure turbo-alternators. Each of the 45ft diameter 31ft high reactors will contain about 2,600 fuel channels and will be housed in a 67ft

An artist's impression of the nuclear power station to be built at Berkeley, Gloucestershire, by the A.E.I.-John Thompson Nuclear Energy Co. The two reactors can be seen on the right and the turbine hall on the left





An artist's impression of the completed South of Scotland nuclear power station

diameter 3in thick steel sphere. The cooling gas pressure will be 130 lb/sq in. The reactors will be refuelled on load, a small number of channels being replenished almost every day. Three 20 MW variable speed turbo-generators (one being a standby) will supply power to six axial flow blowers. Two station transformers and six unit transformers are to be provided.

Associated with C. A. Parsons & Co., Ltd., in the construction of this station are Clarke, Chapman & Co., Ltd., and Head, Wrightson & Co., Ltd.

South Scotland Station

Simultaneously with the announcement of the C.E.A. awards the South of Scotland Electricity Board announced the award of the contract for its nuclear energy station to the G.E.C.-Simon Carves Atomic Energy Group.

The generating plant capacity of the station will be 360 MW while the total output capacity is guaranteed to be not less than 300 MW, rising to 320 MW, all of which will be fed into the national grid. As a base-load installation the station will have an energy output of from five to six million kWh per day, representing a saving of about a million tons of coal a year. The station will have two nuclear reactors, each with eight steam raising units, and the whole structure, weighing about 70,000 tons in each case, will be supported on thick concrete rafts. The erection programme will be greatly assisted by a specially built Goliath crane, with a 200ft span, which will be capable of lifting up to 300 tons at a time.

Associated with the atomic energy group in this enterprise are the Motherwell Bridge & Engineering Co., Ltd., who will provide the pressure vessels, and John Mowlem (Scotland), Ltd., who will undertake the civil engineering works.

The cylindrical core of each reactor will be 28ft high and 50ft in diameter and will be built up of 2,000 tons of graphite blocks containing vertical channels for the fuel elements and control rods. Each of the 3,288 fuel channels will contain ten individual fuel elements aligned in a column, one element on top of the next. Each element will consist of a bar of natural uranium metal sealed in a finned magnesium

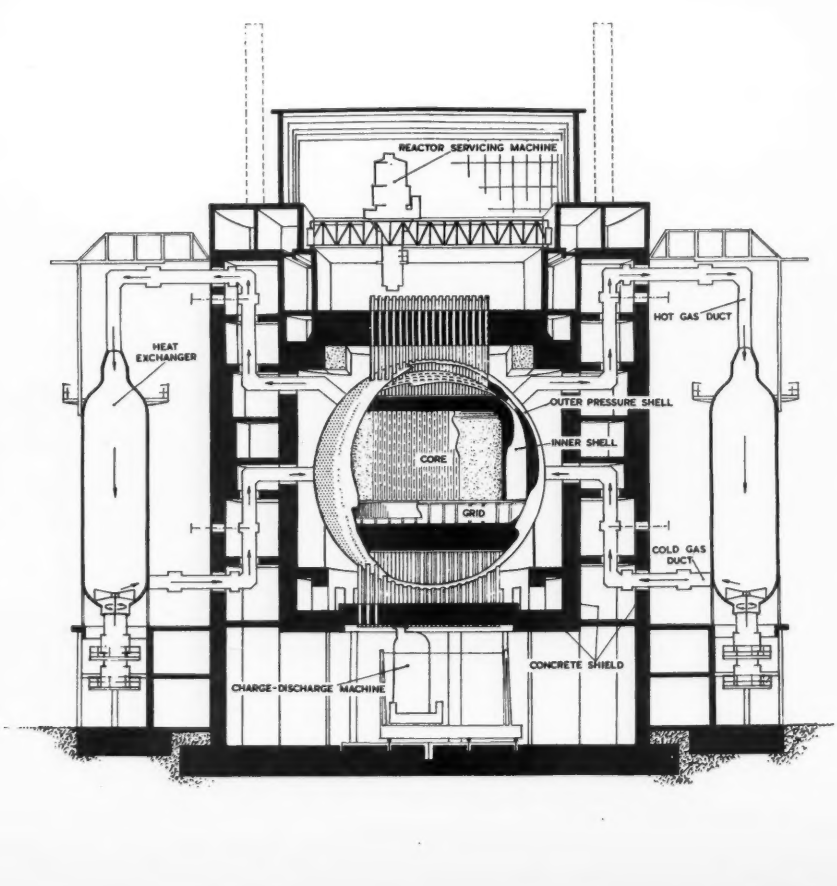


Diagram of the design of the reactor for the Scottish station, showing the direction of heat transfer gas through the reactor core and heat exchanger

alloy can. The total charge of uranium in the two reactors will be 500 tons. The reactor core will rest on a steel grid, and surrounding the core will be an inner steel shell made of relatively thin steel plate.

A 70ft diameter spherical pressure vessel, welded from 3in thick steel plate and weighing nearly 1,000 tons, will completely enclose the core and inner shell, and the double-shell construction will enable the best materials to be used for each purpose. A temperature resistant steel will serve for the hotter, inner shell, and a tough, non-brittle steel for the spherical vessel which will have to withstand the full working gas pressure. Protection from nuclear radiation will be provided by a 9ft to 10ft thick concrete biological shield surrounding the core and forming one face of the 180ft high reactor building.

Charge and discharge of the fuel elements into and from the channels will be effected, ten at a time, by a single remotely-controlled machine situated in a shielded chamber beneath the reactor. This machine is so designed that the removal of spent or damaged fuel elements and the charging of fresh fuel will be carried out while the reactor is on load and under pressure. It will be controlled from a room in the reactor building where the sequence of operations will be viewed on closed-circuit television screens.

Heat will be extracted from the nuclear reactor by carbon-dioxide gas which will be circulated throughout the system at 150 lb/sq in. Eight steam generating units will be radially disposed in pairs round each reactor, and they will contain banks of steel tubes through which the water and steam will flow. The steam raising unit tubes will be finned to provide an extended surface and thus improve the efficiency of heat transfer. The 16 steam generating units for the complete station will contain about 300 miles of tubing. In the base of each 210 ton unit will be an electrically driven 2,200 h.p. blower which will recirculate the cool gas through the reactor.

Steam from the steam raising units will be piped over a bridge to the 700ft long turbine hall, which will contain six 60 MW dual-pressure turbo-alternator sets. Apart from all the ancillary feed heating and condensing plant, the turbine hall will also house the main control room in which the control of the reactors, heat exchangers and turbo-alternators will be centralised.

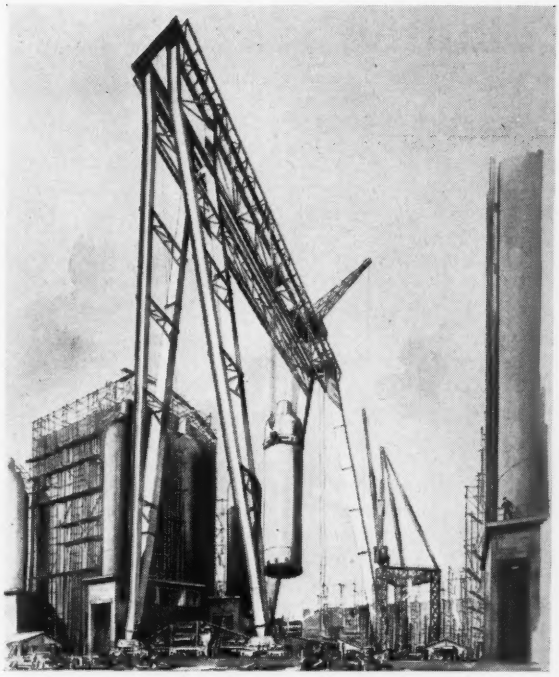
Between the two reactor buildings will be an 18ft deep cooling pond in which the irradiated or spent fuel elements will be allowed to "cool off" radioactively before they are reprocessed.

Among the principal sub-contractors are Colvilles, Ltd.; the Harland Engineering Co., Ltd.; Glenfield & Kennedy, Ltd.; James Howden & Co., Ltd.; Cockburns, Ltd.; Stewarts & Lloyds, Ltd.; and Kenyons (of Stirling). The maximum use will be made of local resources and labour, and the whole project will bring a large amount of work to Scotland.

The Board hope to construct this station on the Ayrshire coast. They have applied to the Secretary of State for Scotland for consent to the construction of the station in terms of the Electricity Acts, for planning permission, and for confirmation of an Order for the compulsory acquisition of a site. These applications are still under consideration.

At a Press conference on Thursday last week further particulars of the Scottish station were given by Messrs. A. L. G. Lindley (the director of the G.E.C. in charge of the company's nuclear energy programme) and Mr. R. N. Millar (manager of the company's Industrial Atomic Energy Department).

Mr. Lindley said that for the work on this project they had "skimmed the cream" of the G.E.C.'s technical staff and the expenditure was probably in the nature of £2 million. About 350 people had been employed full-time and 150 part-time on the development work.



Impression of the Scottish nuclear power station under construction, showing the Goliath crane lifting a complete prefabricated heat exchanger shell into position

The cost of the station would be of the order of £35 million; the figure would be varied according to any modifications found necessary during the course of construction. No special financing arrangements would be needed by the company.

Pending the release of further details later, it could be said that the high-pressure steam conditions would be 585 lb/sq in and 700 deg F and the l.p. conditions 155 lb/sq in and 670 deg F. The gas inlet temperature would be 200 deg C, the outlet temperature 400 deg C and the can temperature of the order of 425 deg C. Fuel elements would be similar in character to those at Calder Hall but would be 2ft long to fit in with the on-load charging system.

A start would be made early next year; the first section should be commissioned in the early part of 1961 and the rest by the end of that year. The designed life of the station was twenty years but it was hoped that it would go on beyond that period.

The maximum output would be 360 MW; it was anticipated that 40 MW would be used in the station, leaving a net output of 320 MW. The thermal efficiency was put at 28·8 per cent. The production cost per kWh, taking credit for the sale of plutonium, was expected to be under 0·7d/kWh with an annual load factor of 80 per cent (as a base load station).

Scientific Instruments Exhibition

The forty-first Exhibition of Scientific Instruments and Apparatus, organised by the Physical Society, will be held from 25th to 28th March next at the Royal Horticultural Society's Halls, Westminster, S.W.1.

European Co-operation

SPEECHES AT THE BRITISH ENGINEERS' ASSOCIATION LUNCHEON

AT the annual luncheon of the British Engineers' Association on 13th December the principal guest was His Excellency Jonkheer H. F. L. K. van Vredenburch, chief representative in the United Kingdom of the European Coal and Steel Community.

In the course of his introductory remarks the president of the Association, Mr. W. Kenneth G. Allen, said that the B.E.A. had served industry for over forty years. It was interesting and important to note the trend of the pattern of this country's exports over that period. In 1913, textiles represented 34 per cent of the total value of visible exports while engineering contributed only 12 per cent. Last year those figures were virtually reversed and this year engineering exports would reach a new " all time high," expressed in absolute money terms. In relative terms, too, it would be surprising if the engineering industries' proportion of the whole of the country's exports did not better the previous figures.

Mr. Allen said that progress was tremendously dependent on the organisation of monetary resources. They wondered sometimes whether enough forward thinking was put into the question of mobilising the necessary finance required in connection with large overseas developments and projects.

Mr. Allen also drew attention to the recent formation of the Nuclear Energy Trade Associations Conference, in which the British Engineers' Association, with other associations, had established a permanent means of liaison on matters relating to nuclear energy; and to the co-operation which existed between engineering trade associations in fourteen countries of Western Europe, through ORGALIME (liaison organisation for the metal using industries of Europe).

Jonkheer van Vredenburch, in the course of his speech, referred to present trends in European co-operation. He said that until recently very few people on the Continent seemed to believe that Britain was in earnest about a free trade area, but the statement made by the Government on 26th November had made the intentions of future British economic policy much clearer.

All European countries were dependent on oil imports from abroad. This was not a passing phenomenon; here was at least one vital common interest, namely, to avoid economic strangulation as a result of a critical shortage of power.

There existed general agreement in the Benelux countries that progress so far, if not sensational, had been quite satisfactory, and that the results of their common economic policy had been beneficial to the three nations concerned. Economic co-operation on a wider basis had been achieved through the O.E.E.C., a body by which economic European problems could be considered as a whole, and measures could be discussed to deal with economic matters which affected them all.

Speaking of the European Coal and Steel Community Jonkheer van Vredenburch said that at first that organisation was viewed with scepticism and strong misgivings, but they were confident that as time went by the United Kingdom and the Community would succeed in fully co-ordinating their action in the fields of coal and steel.

Benelux, O.E.E.C. and the European Coal and Steel Community were all three firm achievements for closer economic co-operation in Europe. But there were also several promising signs for the future. First Euratom, next the general European common market, and last but not least the proposal for a European free trade area, which this country and perhaps other European nations could join.

Euratom would be a European organisation for the development and the peaceful use of atomic energy. The United Kingdom had invested heavily and successfully in nuclear power and it was understandable that there was not much interest in joining an organisation of six Continental countries which had still a long way to go before their achievements were in any way comparable. Although it had been said that Calder Hall had put Britain ahead for at least ten years the speaker warned his audience that the United States and Russia were devoting great financial and technical resources to nuclear development. The six European Governments were convinced that their only hope to catch up eventually with the leading powers in the atomic field lay in pooling their resources. He was convinced that once that was done, once Euratom was established and got under way—if not before—close co-operation between that organisation and the United Kingdom would be established. He was certain that that association would, in the long run, be to their mutual interest.

The common European market was a logical extension of the Benelux idea and of the European Coal and Steel Community, which had both proved to be highly beneficial. After giving a brief outline of the projected customs union and common market, Jonkheer van Vredenburch said he hoped that what he had said would convince them that if the avowed aim was the freeing of trade, it was not free trade in the classical sense. They were very much alive to the fact that the consequences might mean hardship for some and that whoever they were, they had a right to be helped by the community as a whole, which would reap the benefit of this policy.

Soldering Aluminium Cables

OWING to the increase in the relative prices of copper and aluminium there has recently been a great revival in the use of the latter metal as an electrical conductor. It has therefore become necessary for staffs to be trained in its use and particularly to be instructed in jointing techniques. This task will be greatly facilitated by a study of a booklet published by the Aluminium Union, Ltd., The Adelphi, John Adam Street, London, W.C.2.

After dealing briefly with some characteristics of aluminium stranded conductor and the nature of the soldering problems the main sections of this publication cover jointing techniques employing both organic and reaction fluxes and describe, with the help of copious illustrations, the procedure required for making the various types of joints. A further section is devoted to the jointing of sheaths. The techniques illustrated were chosen after an exhaustive survey, supported by laboratory tests, had been made of the many methods currently employed and the assurance is given that they will give satisfactory service.

AUSTRIA'S ELECTRICAL TRADE

Smaller British Share in 1955

ELECTRICAL exports from Austria amounted to £7·4 million last year, an increase of 26 per cent over 1954. Austria's electrical imports in 1955 were £9·9 million, representing an increase of 35 per cent (see Tables 1 and 2). Most of the trade is with neighbouring countries, with West Germany in the lead. Details of distribution are given in Tables 3 and 4. (£1=72·80 schilling.)

TABLE 1.—Austria's Electrical Imports (million schilling)

Country	1954	1955	1st half 1956
United Kingdom	51	39	18
West Germany	317	466	261
Italy	15	24	15
Switzerland	70	82	47
Holland	41	70	38
Sweden	14	23	12
United States	7	15	14
Total (inc. others)	533	725	424

TABLE 2.—Austria's Electrical Exports (million schilling)

Main Markets	1954	1955	1st half 1956
United Kingdom	6	5	3
Czechoslovakia	5	12	9
West Germany	24	42	31
Italy	28	26	8
Jugoslavia	55	56	22
Poland	41	44	20
Switzerland	20	26	10
France	7	11	5
Greece	13	12	6
Holland	24	57	45
Sweden	18	14	10
Turkey	25	18	9
India	13	8	6
Pakistan	—	2	2
Egypt	9	11	10
South Africa	6	6	3
United States	11	23	7
Argentina	7	18	2
Brazil	13	8	3
Australia	6	8	4
Total (inc. others)	418	531	302

TABLE 3.—Exports by Main Commodity Groups (000 schilling)

Country	1954	1955	1st half 1956
Steam turbines.—			
West Germany	1,237	800	—
Jugoslavia	—	—	1,245
Egypt	—	42	—
Total (inc. others)	1,707	842	1,545
Steam turbine parts.—			
West Germany	4,985	752	1,215
Jugoslavia	—	20	—
Switzerland	12	154	449
Hungary	126	650	7
Total (inc. others)	5,123	1,556	1,674
Water turbines.—			
East Germany	—	4,302	33,704
Jugoslavia	3,813	2,467	—
Turkey	—	861	—
Russia	—	23,022	19,471
Mexico	—	10	—
Total (inc. others)	5,729	30,692	55,887
Water turbine parts.—			
West Germany	396	1,077	2,097
Jugoslavia	107	11	—
Poland	—	126	126
Russia	—	—	1,053
Bulgaria	62	5	71
Brazil	152	238	—
Total (inc. others)	1,255	1,461	3,423
Motors and generators.—			
West Germany	1,117	5,294	4,711
Italy	2,494	2,370	1,229
Jugoslavia	4,545	3,774	1,850
Poland	21,110	15,130	2,223
Switzerland	2,422	3,051	1,920

After a slight increase in 1954, the United Kingdom's electrical exports to Austria fell by approximately 23 per cent last year. Table 5 shows the details of these exports for selected products. In addition to these this country provided small quantities of mercury-arc rectifiers, arc welding equipment, cookers, water heaters, food mixers and electro-medical apparatus.

TABLE 3.—Exports by Main Commodity Groups (000 schilling)—*continued*

Country	1954	1955	1st half 1956
Motors and generators (continued)			
Bulgaria	715	1,344	1,175
France	1,290	1,393	513
Greece	885	1,358	816
Holland	1,040	1,831	986
Sweden	3,508	1,079	637
Turkey	4,664	4,717	1,326
Russia	—	4,373	27,843
India	6,928	1,394	2,302
Egypt	4,078	1,314	726
South Africa	1,173	1,525	936
Argentina	—	4,876	—
Total (inc. others)	68,145	63,090	58,997
Rotary convertors.—			
West Germany	1,193	2,054	1,367
Italy	1,000	1,296	899
Jugoslavia	1,256	2,348	177
Poland	73	1,778	1,840
Finland	296	1,118	473
Turkey	821	2,722	718
South Africa	1,708	1,097	184
Total (inc. others)	10,493	19,681	9,466
Transformers.—			
West Germany	453	2,825	2,316
Czechoslovakia	231	1,224	132
Italy	608	1,586	139
Jugoslavia	10,128	6,383	423
Poland	180	2,395	1,245
Switzerland	1,632	5,985	111
France	8,300	4,118	1,302
Sweden	7,888	4,862	5,087
Turkey	7,974	4,738	4,213
India	4,691	4,700	2,546
Pakistan	155	1,302	8
Egypt	809	9,478	1,528
South Africa	1,894	1,274	1,116
United States	9,025	18,508	4,899
Canada	114	2,147	3,458
Brazil	4,086	2,189	5
Australia	3,520	7,033	3,974
New Zealand	—	4,340	1,475
Total (inc. others)	70,052	90,641	40,795
Telephone apparatus —			
Italy	131	8,639	1,002
Jugoslavia	191	4,234	2,375
Holland	11	4,731	7,154
United States	12	1,798	1,029
Total (inc. others)	22,429	26,501	14,571
Radio receivers and chassis.—			
Italy	568	1,189	18
Jugoslavia	1,172	1,311	260
Switzerland	2,407	2,344	446
United Kingdom	2,645	1,274	508
Holland	218	2,641	624
Iraq	2,415	2,867	1,498
Iran	678	1,040	648
Syria	906	1,229	138
Egypt	3,230	1,292	1,316
Total (inc. others)	22,982	22,989	10,133
Electro-acoustical equipment.—			
West Germany	761	3,528	7,706
Jugoslavia	647	1,013	3,842
Switzerland	1,700	1,858	496
Holland	9,879	30,727	2,902
Total (inc. others)	19,300	45,466	28,076
X-ray and electro-medical equipment.—			
West Germany	1,273	1,684	1,574
Italy	1,005	1,337	704
Argentina	965	6,209	284
Brazil	424	1,203	224
Total (inc. others)	9,862	13,913	14,087

(*Continued on next page*)

AUSTRIA'S ELECTRICAL TRADE (continued)

TABLE 3.—Exports by Main Commodity Groups (000 schilling)—*continued*

Country	1954	1955	1st half 1956
Measuring and recording equipment.—			
West Germany	1,597	2,382	1,264
Jugoslavia	2,975	3,389	1,014
Poland	1,927	3,813	2,618
Sweden	1,388	1,998	1,427
Egypt	1,060	1,473	61
China	2,964	3,095	1,030
Argentina	1,101	1,904	245
Total (incl. others)	21,464	25,050	12,966
Filament lamps.—			
West Germany	3,014	3,477	1,448
Switzerland	1,952	2,007	1,084
Argentina	897	2,960	—
Total (inc. others)	8,371	12,054	6,230
Electronic tubes.—			
Italy	434	1,644	26
Jugoslavia	406	1,267	167
Poland	—	1,209	62
France	6	1,026	373
United Kingdom	584	1,407	190
Holland	3,019	5,362	5,721
Total (inc. others)	6,282	15,077	7,606
Heating appliances.—			
Czechoslovakia	2,117	8,420	1,422
West Germany	477	1,552	2,028
Italy	749	1,119	447
Jugoslavia	6,517	2,577	706
Poland	2,862	1,316	115
Switzerland	1,802	3,121	1,265
Total (inc. others)	18,931	22,444	8,278
Cables and wires.—			
East Germany	345	1,987	199
Jugoslavia	1,421	3,171	2,237
Poland	490	5,735	3,894
Bulgaria	1,730	2,134	324
Iceland	1,458	1,738	41
Total (inc. others)	10,295	18,071	7,723

TABLE 4.—Imports by Main Commodity Groups (000 schilling)

Country	1954	1955	1st half 1956
Motors and generators.—			
West Germany	20,381	42,086	17,976
Italy	220	239	394
Poland	376	80	330
Switzerland	7,244	3,382	1,951
Belgium	160	189	1,478
Denmark	801	381	50
France	165	114	59
Holland	1,014	3,648	1,664
Sweden	700	960	157
United States	427	619	66
Total (inc. others)	32,550	53,697	54,829
Complete generating sets.—			
West Germany	2,016	2,508	556
East Germany	1,397	—	—
Sweden	1,243	—	—
United States	—	60	156
Total (inc. others)	4,828	2,568	741
Portable tools.—			
West Germany	77,605	108,886	63,052
Italy	939	1,710	996
Switzerland	3,306	10,360	9,014
Belgium	734	1,629	701
Denmark	226	351	163
Holland	3,778	7,703	3,679
Sweden	9,067	15,530	9,305
Total (inc. others)	108,361	155,675	97,623
Rotary convertors.—			
West Germany	556	1,467	560
Switzerland	3,785	8,967	2,368
Total (inc. others)	4,816	10,663	2,995
Transformers.—			
West Germany	12,396	13,661	5,209
Italy	906	268	246
Switzerland	12,113	3,542	1,589
Holland	554	1,247	447
Total (inc. others)	26,803	20,155	8,093
Telephone equipment.—			
West Germany	3,669	7,157	2,948
Total (inc. others)	22,429	9,714	5,611
Radio receivers.—			
West Germany	730	761	153
Italy	357	354	122
Switzerland	78	11	18
Total (inc. others)	1,330	1,254	328

TABLE 4.—Imports by Main Commodity Groups (000 schilling)—*continued*

Country	1954	1955	1st half 1956
Radio components.—			
West Germany	6,801	9,091	3,866
Denmark	239	786	568
Holland	9,674	16,649	8,213
Total (inc. others)	17,439	27,888	12,954
Radio transmitting equipment and electronic instruments.—			
West Germany	7,434	8,403	9,002
Switzerland	1,242	966	327
Sweden	277	109	—
Total (inc. others)	9,097	10,424	10,725
Electro-acoustical equipment.—			
West Germany	7,576	11,306	7,706
Switzerland	363	337	496
Denmark	658	3,046	1,613
Holland	401	3,273	2,902
Total (inc. others)	10,165	29,340	28,076
Television receivers.—			
West Germany	1,691	5,488	7,462
Holland	861	1,518	10
Total (inc. others)	2,568	7,739	7,483
Electronic apparatus.—			
West Germany	6,157	16,008	7,612
Italy	218	61	10
Switzerland	1,036	1,098	501
Holland	157	937	307
Total (inc. others)	8,146	19,155	13,077
X-ray and electro-medical apparatus.—			
West Germany	9,647	15,054	6,479
Switzerland	239	281	353
Denmark	136	177	156
Holland	1,085	2,655	1,605
Sweden	381	727	86
Total (inc. others)	11,786	20,410	8,915
Electronic valves.—			
West Germany	1,116	2,347	974
Switzerland	1,638	606	522
Hungary	799	1,015	346
Holland	6,737	12,415	6,570
Total (inc. others)	10,803	18,512	9,125
Heating appliances.—			
West Germany	18,046	32,206	14,972
Italy	6,389	12,672	6,345
Switzerland	602	1,303	3,067
Sweden	105	231	137
United States	144	299	140
Total (inc. others)	25,697	48,423	25,513
Cables and wires.—			
West Germany	3,019	7,769	3,689
Switzerland	1,925	2,654	1,434
Holland	1,253	616	312
Total (inc. others)	16,585	28,455	5,986
Steam turbines.—			
West Germany	—	7,121	2,097
Switzerland	—	462	—
Total	—	7,583	2,097
Water turbines.—			
West Germany	3,337	984	—
Switzerland	—	15,048	11,932
Total	3,337	16,032	11,932

TABLE 5.—United Kingdom's Principal Electrical Exports to Austria (£)

Product	1954	1955	1st half 1956
Complete generating sets	900	5,461	—
Generators	10,302	2,769	—
Motors under 1 h.p.	3,707	11,452	5,028
Motors from 1 h.p. to 250 h.p.	1,122	169	713
Parts of motors	2,193	823	267
Starting and control gear	1,021	556	3,007
Transformers	67,614	1,246	38
Switchgear and switchboards	17,912	91	—
Space heaters	1,126	6,581	129
Parts of cooking and heating appliances	391	780	60
Flat irons	—	6,943	2,270
Vacuum cleaners	13,045	7,711	7,699
Floor polishers	6,587	3,883	3,340
Fans	2,020	1,333	171
Refrigerators	30,083	49,210	32,734
Washing machines, not exceeding 150 lb	131,877	70,790	22,756
Ditto, ditto 150–250 lb	1,213	11,038	629
Commercial instruments	3,829	668	672
Scientific instruments	4,711	6,740	7,573
X-ray apparatus	1,452	1,372	687
Telephone equipment	252,100	34,100	32,510
Cables and wires	136,133	236,935	6,082
Total (including other products)	712,214	542,283	251,317

Power Supply in South Africa

EXPANDING REQUIREMENTS OF GOLD AND URANIUM MINES

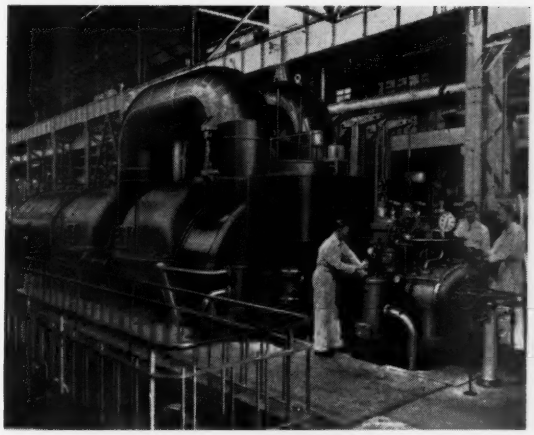
FOR the most part the Electricity Supply Commission of South Africa is now able to meet the full requirements of consumers in all its undertakings, but no slowing down of development and new construction is anticipated. This is stated in the Commission's latest annual report which covers the year 1955, and briefly reviews its activities up to the end of April last. The improvement in the supply position followed the commissioning of new plant at Taaibos, Vierfontein and Wilge power stations, which made it possible after the winter of 1955 to relax the control on maximum demands of consumers served by the Rand and Orange Free State undertakings. In some areas it is still necessary to maintain limitations until reinforcement of major transmission and distribution networks is completed. The aggregate of future demands already notified to Escom indicates that for some years at least expansion of electricity supply must continue at or about the rate which has obtained during the post-war years.

The report records that in the past year 330 MW of new generating plant was completed, raising the installed capacity of Escom stations to 2,531 MW, with an additional 780 MW under construction or on order.

The mining industry, with a consumption of 6,176·3 million kWh, was again the Commission's biggest customer, taking 11·8 per cent more electricity than in 1954. Municipalities (2,051 million kWh) occupied the second place, and showed an increase of 11·4 per cent over 1954. Industry other than mining came third with a consumption of 1,890 million kWh and showed an increase of 22 per cent over 1954. The report says that the most significant development has been the increase in sales in bulk to municipal undertakings. These figures reflect not only the growth of the municipal electricity undertakings, but also the abandonment of local generation in many municipalities in favour of bulk supply from Escom. In 1939, Escom supplied 37 local authorities with about 365 million kWh; in 1955 these figures had increased to 98 local authorities and 2,051 million kWh.

ESCOM OPERATING RESULTS

	1955	1954	Inc. or dec.
			Per cent
Total revenue	£22,735,571	£18,513,220	+22·8
Total production costs (including interest, redemption and reserve fund charges)	£22,430,974	£18,428,977	+21·7
Balance	£304,597	£84,243	+£220,354
			Per cent
Average price/kWh sold	0·4967d	0·4569d	+ 8·7
Average cost/kWh sold	0·4910d	0·4571d	+ 7·4
kWh generated, millions	12,214	10,652	+14·7
kWh sent out, millions	11,425	10,072	+13·4
kWh purchased, millions	339	437	−22
kWh sold, millions	10,964	9,676	+13·3
Coal consumed (in tons of 2,000 lb) ...	9,920,451	8,845,950	+12·1
Total cost of coal consumed (including railage)	£6,854,516	£5,664,282	+16·2
Railage on coal consumed	£2,423,183	£2,084,895	+21·0



One of two Metropolitan-Vickers 30 MW two-cylinder steam turbo-generator sets manufactured for the Electricity Supply Commission of South Africa and installed at Wilge power station, about 70 miles from Johannesburg

The increase in the Commission's sales to mining consumers included 1,187 million kWh sold to twelve new mines in the Orange Free State goldfield which is still in process of development. It has been forecast that the electricity requirements of the area will be doubled within the next decade. In the Klerksdorp area five new mines have been started since 1945; of these mines only three have commenced milling, so that further large quantities of power will be required in this area as development proceeds. The increase in mining supplies also reflects the additional requirements of mines in the old area and in the new areas for the mining and extraction of uranium ores. The 1955 statistics do not include any supply to the new gold mining area in the Bethal district to which a supply was made available in February, 1956, and where large quantities of electricity will be needed.

Collieries do not require the very large quantities of power that are consumed by the gold mines. Nevertheless, Escom has been called upon to increase the supply of electricity for collieries in the Natal and Transvaal coalfields about threefold during the period 1939 to 1955.

275 kV Transmission Scheme

With the decision to establish the new Highveld power station near Coalbrook, O.F.S., with an ultimate capacity of eight 60 MW generators, it became necessary to provide adequate facilities for transmitting the output of the station to the O.F.S. goldfields. Consideration was given to the provision of additional 132 kV lines into the area but network studies clearly indicated that there would be considerable economic advantage in using a higher transmission voltage for this purpose. A voltage of 275 kV was decided upon as being the most suitable and also because it would make possible the use of 300 kV class equipment, recently adopted as an international standard when de-rated for an altitude of 5,000ft. Two parallel single circuit 275 kV transmission lines, 98 miles route length, are being constructed. Each line will be capable of transmitting the whole of the output of the new power station when complete, that is, 440 MW.

Construction of the first line was completed in August, 1956, and it is proposed to operate it at 132 kV initially for transmission from Taaibos power station to the O.F.S. network until power is available from Highveld power station. By this means it has been possible to obviate

the necessity for constructing an additional 132 kV line for transmission into the O.F.S. which would have become redundant when the 275 kV system was put into service.

A local loan of £10 million recently offered for public subscription on behalf of the Electricity Supply Commission bears interest at 5⅛ per cent and will mature in 1977-82, the issue price being £100 per cent. The loan will be used to repay temporary borrowings in connection with the construction of the Vierfontein, Taaibos, Highveld, Umgeni, West Bank, East London and other power stations, and on extensions to the transmission and distribution systems of the Rand and the Orange Free State, Cape Western and other undertakings, for supplies to various consumers.

In his annual report, the city electrical engineer of Cape Town (Mr. C. C. Downie) says that 1955, in which the Council's electricity undertaking reached its diamond jubilee, was a very successful year. Revenue amounted to £3,455,719 and expenditure to £3,155,031, leaving a net profit of £300,688. Of this surplus £99,040 went to the Council's general rate fund and £3,857 to the repairs fund, leaving £191,791 for the tariff and assessment rate stabilisation account. Mr. Downie says that one of the remarkable aspects of the Cape Town Electricity Department is the relatively small amount of loan capital required to finance expenditure. Whereas total capital expenditure up to the end of 1955 was £13,017,726, only £9,891,758 of this has been financed from loans, the remainder having been provided over the years by contributions from revenue—that is to say, profits to the extent of £3,125,968 were re-invested in the undertaking.

In addition, up to the end of 1955, the electricity undertaking had contributed £3,518,087 from revenue to the city's general rate fund.

Fuel and Power in the United Kingdom

IN a paper read before the Institute of Fuel on 5th December, Dr. L. F. Haber examined our past and present supplies of coal, gas, electricity and fuel oil and then dealt with our future requirements.

Coal, it was pointed out, would remain the country's principal source of energy and there was no fear of its early exhaustion. The production of deep-mined coal had risen from 175 million tons in 1945 to just over 210 million tons in 1955, a result which was due to increasing mechanisation and compared favourably with the mines in Western Europe. During the same period the pattern of coal consumption had altered considerably. Electric power stations now accounted for about one-fifth of the total and, while the demand for household and miners' concessionary coal had not changed much, that for general industrial consumption was slowing down, partly because other sources of energy were being utilised and partly because rises in price had resulted in economies. The same was true of railways, offices, shops and small industrial establishments, the greater part of whose increasing needs were being met by coke, oil, gas or electricity.

Turning to the secondary fuel industries the author said that the gas industry made good use of the nation's coal and it was desirable that its share in the supply of energy requirements should grow. To effect this would mean that its price must be sufficiently low to penetrate new and recapture old markets and to do this changes would be necessary in methods of manufacturing and marketing practices. In dealing with the electricity supply industry the important role of load factor in the economics of the industry was stressed. Its value would have to be increased and this could only be achieved by the expansion of off-peak domestic consumption.

The remarkable growth in the consumption of fuel, gas and diesel oils, which rose from 4·5 million tons in 1948 to 9·6 million tons in 1955, was due to their technical superiority for many purposes, although they were more expensive. This expansion was likely to continue at a greater rate in future, since coal could not meet the country's energy requirements and atomic energy would not make a significant contribution before the late sixties. In fact, in 1965 it was estimated that oil consumption would reach 25 million tons, corresponding to 42 million tons of coal.

On the basis of these arguments the author estimated that the country's requirements of fuel (excluding road and air transport, exports and reserves) would have risen from 232 million tons of coal and coal equivalent in 1955 to 285 million tons in 1965 and to 367 million tons in 1980. In 1965, 230 million tons of these requirements could be met by coal, 2 million tons by water power and 11 million tons by atomic energy, leaving a deficiency of 42 million tons. In 1980, 240 million tons of the total requirements could be met by coal, 2 million tons by water power and 90 million tons by atomic energy, leaving a deficiency of 35 million tons. The size of the gap in relation to the total consumption was small and there was some justification for the statement that it could be filled by the use of oil.

Much more information was, however, needed on the pattern of use of primary and secondary fuels. For many years the consumption of the latter had grown more rapidly than of the former and it was commonly assumed that this would continue. The question was to what extent the use of oil fuels would increase and whether this would lead to a better use of the nation's indigenous supplies. The answers so far had not given the whole picture but only that part of it which was concerned with the particular fuel industry under investigation.

Statistics showed that the effect of the rising cost of fuel on industry was relatively insignificant and that dearer coal would not make it difficult for us to meet foreign competition. Indeed, it was worth noting that British pithead costs were 10 to 20 per cent lower than those in Germany and about 33 per cent lower than those in France. Our problems, in fact, were not due to price, but to our methods of utilising energy. On the Continent coal mining was closely integrated with coke, gas and electricity production and this saved expenditure on freight. Gas and electricity interchange arrangements were highly developed, which resulted in a better use being made of existing capacity. This was reinforced by the tariff structure which cheapened their cost appreciably as longer hours were worked.

The conclusion that must be reached was simply that the country's needs for energy were rising more rapidly than the supply of indigenous fuel. The gap could not be narrowed quickly by increasing coal production, expanding hydro-electric capacity or building atomic stations. For the next 20 to 25 years therefore we should be more dependent than at present on imported fuels.

V.H.F. Sound Broadcasting

DESIGN AND PERFORMANCE OF TRANSMITTING EQUIPMENT

TWO papers relating to the recently inaugurated frequency-modulated very-high-frequency sound broadcasting system of the British Broadcasting Corporation were presented on 12th December before the Radio and Telecommunication Section of the Institution of Electrical Engineers. Messrs. E. W. Hayes and H. Page (B.B.C.) explained that deteriorating reception due to the growth in the number of low- and medium-frequency stations had resulted in the B.B.C.'s decision to construct stations operating within the v.h.f. range internationally allocated to it of 87·5 to 100 Mc/s, at which there was freedom from interference by reflection at the ionosphere, from foreign stations and from domestic appliances. A disadvantage was rapid decrease in signal strength with distance from the transmitters, depending upon the nature of the terrain. Field trials indicated that beyond 30 miles the frequency-modulated system was much more acceptable to listeners than the amplitude-modulated system either with or without impulsive-noise limitation. All European countries introducing v.h.f. systems had decided to use frequency modulation.

Experience of the first year's operation of ten B.B.C. v.h.f. stations constituting the first stage of the development plan (authorised in 1954) was recounted, with special reference to the performance of commercial receivers. With the further six stations authorised this year for service in 1958, 96 per cent of the population of Great Britain and Northern Ireland would be covered, and later, with additional stations, 98 per cent. In most cases three programmes were radiated from a common aerial. The transmitting equipment was provided by Marconi's Wireless Telegraph Co. and Standard Telephones & Cables, the masts by British Insulated Callender's Construction Co. and J. L. Eve Construction Co. and the aluminium aerial quadrants by Hawkesley-S.M.D.

The planning and design of the transmitting equipment used at the new v.h.f. sites were surveyed by Messrs. A. C. Beck, F. T. Norbury and J. L. Storr-Best (Standard Telephones & Cables), who described a 10 kW transmitter operated within the 87·5 to 100 Mc/s band, including the method of generating the f.m. carrier, its automatic centre-frequency control and means for automatic phasing of paralleled high-power amplifiers. The B.B.C. specification embodied these main requirements: ability to work on a strictly unattended basis; duplication of transmitters to maintain continuity of service, the two high-power amplifier chains working in parallel and kept in phase within a few degrees; and a combination of three independent 10 kW f.m. carriers spaced 2·2 Mc/s apart to feed one-half of a wide-band horizontally polarised aerial, the other half being fed with an identical set of transmitters. Overall performance figures were quoted.

Discussion

Sir Noel Ashbridge said that all the controversial questions that were so acute and gave so much embarrassment at the time had now been answered and there was frequency modulation in most European countries. The combination of television stations with the v.h.f. sound service was planned in advance and to put sound on top of television stations was too tempting to resist. The ideal would be to use medium frequencies and v.h.f. as complementary to each other but this had not been entirely achieved in any country and the latest B.B.C. plan was a sound compromise.

Mr. B. N. MacLarty said that the three papers recorded a most important and significant engineering achievement by the B.B.C. and the contracting firms involved in the project. Sir Noel Ashbridge and his team had quietly got down to work with a low-power transmitter to obtain some idea of propagation conditions over London. They had then made the courageous decision to put in two 20 kW transmitters, one amplitude modulated and the other frequency modulated, which enabled them to settle the f.m. versus a.m. argument by controlled experiment. The transmitters and, indeed, the whole station involved some extremely novel features all of which were developed in this country, which owed nothing to the United States. One example was the successful paralleling of transmitters and another was the use of a split aerial system.

Distortion Problem

Sir Harold Bishop said he understood that some half-million v.h.f. receivers had been sold and 90 per cent of those on the market costing £15 without purchase tax had a v.h.f. band. This represented, he was told, some 37 per cent of the total number of sets at present sold. The problem of multi-path-propagation distortion had given some anxiety and was still under discussion with the industry. The complete answer was to put limiters in sets but this would raise the selling price £3 to £5. Mr. Beck's paper, he said, contained many elegant design arrangements, particularly, for example, the square cross-section coaxial line which had considerable advantage.

Mr. J. K. S. Jowett said that there was a time when v.h.f. was thought to be the ideal band for broadcasting because frequencies could be repeated, but things had turned out differently and a large amount of the frequency spectrum had to be used to give national coverage of three programmes. It would be interesting to know when a waveband with the ideal characteristics would be discovered.

Dr. K. R. Sturley said that in some experiments he had made he had found that the saturated amplifier and the variable damping diode were complementary. He thought the authors should qualify their reference to co-channel interference as a function mainly of the limiter, as it was also a function of the discriminator bandwidth, although too much could be made of that. He was pleased to see some indication of uniformity of design in transmitters.

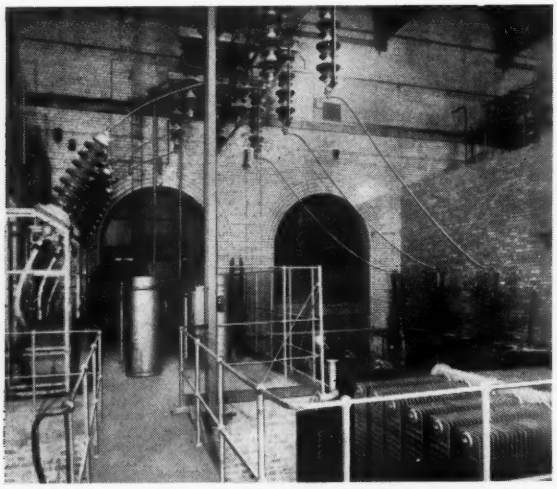
Mr. W. J. Morcom pointed out that one factor about which there was originally some concern was that there appeared to be a law by which the performance of two transmitters in parallel was a mean of the two and resulted in some deterioration. This had been overcome successfully. With regard to automatic phasing, he thought that it was used at the beginning because they were uncertain of the degree of phase stability required. It appeared to be unnecessary, however, and would probably be dispensed with in any future system. The high control equipment and the monitoring gear were, he thought, too complicated. He stressed the merits of good switchgear and conductors. Monitoring gear, particularly in unattended stations, should be kept to the minimum.

Mr. E. T. Norris said that an automatic voltage regulator of 20 kW or more was a power apparatus. In common with all transmitters that had ever existed, whether a.m. or f.m., it was heavy and contained oil, but this had nothing to do with the developments suggested by the authors. He drew special attention to the intimate co-operation that had been involved and to the combination of light and heavy current engineering as well as electrical and mechanical engineering that had been necessary.

GENERATION AND DEVELOPMENT

New Grid Supply Point in Manchester

A new 132/33 kV grid supply point with a total transformer capacity of 180 MVA was opened by the North Western Electricity Board at Dickenson Street, Manchester, on 10th December. The opening ceremony was performed by the Lord Mayor of Manchester, Councillor Harry Sharp.



One of the 60 MVA 132/33 kV transformer bays of the new sub-station which is built in the old engine room at Dickenson Street power station, Manchester

Planning and construction of this grid supply point was carried out by the North Western Electricity Board in conjunction with the North West, Merseyside and North Wales Division of the Central Electricity Authority.

Moorland Electricity Supplies

Although hampered by restrictions on capital investment, the South Western Electricity Board achieved a new record rate of development in rural electrification in the first six months of the current year. Announcing this when he addressed the local branch of the National Farmers' Union at Tavistock last week, Mr. A. N. Irens, the Board's chairman, added that the number of farms in the Area receiving an electricity supply had been increased from 6,300 when the Board took over in 1948 to more than 16,000 at the present time.

Great strides had been made in devising more efficient distribution systems and more economical forms of construction, particularly in overhead lines on which supplies to rural areas would always depend. Moorland areas presented a particular problem, the economic difficulties of serving remote and sparsely populated parts being aggravated because in many cases, as on Dartmoor, the farms and cottages to be supplied came within scheduled parkland areas and there was opposition, mostly from non-residents, to any overhead lines. "No matter how carefully we plan the siting of our overhead lines—and we go to a lot of trouble over this—we invariably seem to meet uncompromising opposition from certain conservationists," he said. "On the moors the rocky sub-soil adds greatly to the cost of excavations and in some places where we have been pressed to go underground costs would be six times higher than for overhead lines." Mr. Irens emphasised that if the Board had to use underground methods extensively the costs would bring development in the parkland areas to a standstill.

The need for electricity in these areas was as great as anywhere in the country; on Dartmoor and Exmoor alone there were over 900 farms and many more cottages waiting for a supply of electricity. Mr. Irens believed that the problem called for a realistic approach and a willingness on the part of organisations concerned to look at all sides of the problem rather than from one viewpoint alone.

Convectors for Council Houses

Lambeth Borough Council is recommended to approve a scheme, estimated to cost £1,760, for the installation of electric convector heaters in dwellings on the Fern Lodge estate.

M.E.B. and Public Lighting

The Midlands Electricity Board has informed Wellington Urban Council that in view of the restrictions on capital expenditure it will be unable to carry out any further work on street lighting schemes during the present financial year but will try to complete all outstanding work early in 1957-58.

The Council, at its meeting on 5th December, decided to make representations to the Board to complete a contract at the Priory estate, Wellington. The clerk, Mr. B. H. J. Renshaw, said the M.E.B. had no power to curtail contracts. Private firms were still tendering for work. Councillor T. Edwards said the columns at the Priory estate had been put up, but the electricity supply was still wanted.

Reduced-Voltage Supplies

Complaints of a drop in the voltage of mains electricity supply in certain areas were made at a meeting of the North Western Electricity Consultative Council recently. Mr. A. O. Johnson, chief commercial officer of the Board, said the principal trouble occurred on old estates where new development was taking place. Not enough money was being made available for distribution systems. In many areas the cables were unable to cope with the extra television sets, immersion heaters and radiators switched on each evening.

Central Heating Installation

Greenwich Borough Council Finance Committee has under consideration a proposal for the installation of an electric night-storage central heating plant at Charlton House. The estimated total capital cost is £1,971 and the General Purposes Committee has suggested that if a loan can be obtained the work should be carried out immediately, failing which it is proposed to include provision to meet the cost of the scheme out of revenue in the forthcoming financial year.

OVERSEAS

1,000 MW Station for Victoria

The Victorian Minister for Electrical Undertakings, Mr. Reid, has announced that the State Electricity Commission plans to construct a power station with up to 1,000 MW capacity at Hazelwood, near the new Morwell open cut. It will be equipped with 200 MW generators and the first unit is expected to be in service not later than 1964. According to Ebasco, an American firm of consulting engineers at present investigating the State Electricity Commission's activities, within the next nine years the Commission must more than double its power supplies. Such expansion will involve a capital outlay of £300 million.

New Zealand Cable Link

The Wellington, New Zealand, correspondent of the *Financial Times* states that the report on the scheme to connect the North and South Islands by a power cable across the Cook Strait is expected to be in the New Zealand Government's hands before the end of the year. British Insulated Callender's Cables, Ltd., in association with the Department of Scientific and Industrial Research and the Royal New Zealand Navy, have been engaged in a survey of the Cook Strait and an investigation of the technical problems involved.

New Lighting Installation in Rotherhithe Tunnel

The central part of Rotherhithe Tunnel showing the fluorescent fittings which have replaced the former filament lamps

ON 5th December a new fluorescent lighting installation in Rotherhithe Tunnel was switched on by the chairman of the London County Council Rivers and Drainage Committee (Mr. E. E. Woods, J.P.). The installation, which consists of 600 fittings (300 on each side of the tunnel and approaches) each with 2ft 40 W "new warm white" fluorescent tubes, replaces the former filament lighting. Although the total load has been increased only from 40·5 to 48 kW, the illumination at the road surface is more than doubled and the amount of light on the tunnel walls—the background against which vehicles are seen—is trebled. A general level of illumination of 2·5 ft-candles is achieved by spacing the fittings 30ft apart at a height of 13ft over the footways.

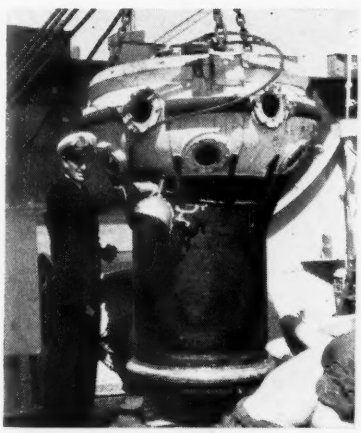
The lighting of tunnels presents difficulties not present in street lighting in that drivers' eyes take time to accommodate themselves to the sudden change from daylight to artificial light. So as to bridge this change, a comparatively high level of illumination has been provided at each end of the tunnel starting at 45ft inside the tunnel (the limit of appreciable daylight penetration) by having as many as 14 fittings in each row of lights in the first 30ft (50ft-candles) and gradually reducing the number per 30ft over a distance of 250ft until the general standard is reached. One shaft is open to daylight and increased artificial lighting has been provided for 160ft on each side of this shaft.

Contracts were let with the City Electrical Co., Ltd., the British Thomson-Houston Co., Ltd., and the London Electricity Board to a total value of £35,000, for the removal of the existing electric cabling and filament lighting and the supply and fitting of new cabling and fluorescent lighting. In order to minimise interference with traffic most of the work was done at night. Fittings made by the B.T.H. Co. were used throughout, including the tunnel approaches, where they are mounted at an angle of 45 deg on tubular columns or brackets. Normally the electricity supply is from both ends of the tunnel, but special wiring arrangements have been made so that in an emergency the whole installation can be fed from either end.

The work was carried out under the direction of the chief engineer to the L.C.C., Mr. J. Rawlinson, C.B.E., M.Eng., M.I.C.E., M.I.Mech.E., assisted by the divisional engineer Mr. C. A. Belcher, M.I.E.E., Mr. F. W. Gillard, A.M.I.C.E., and Mr. H. Hazel, A.M.I.E.E.

Underwater Lamp for Deep-Sea Use

A NEW "Osram" underwater lamp, which will operate down to depths greater than 1,000ft with the bulb in direct contact with the water, has been developed by the General Electric Co., Ltd., in collaboration with the Admiralty Research Laboratory.



Senior Commissioned Boatswain G. Wookey fixes the new G.E.C. underwater lamp to an observation chamber in H.M.S. Reclaim

The success of underwater television depends to a large extent on the introduction of a reliable lamp capable of being used at depths up to 1,000ft. A desirable requirement is that such a lamp should be lightweight, easy to handle, and simple to operate. Experiments at the Admiralty Research Laboratory indicated that all these requirements could be met by using free-flooded lamps, so called because the hydrostatic pressure is resisted by the glass envelope. The lamps operate in direct contact with the water and their success depends on the implosion resistance of the glass envelope.

With the co-operation of the A.R.L. the G.E.C. began development work on prototype lamps, rated at 1 kW, which produced many interesting results. The outer surface of the bulb is cooled effectively by immersion, but the inner surface is heated by radiation and conduction, through the gas filling, from the filament. The severe stresses set up by the thermal gradient in the bulb wall were found to have more bearing on bulb failure than the direct results of pressurised working. The wall thickness finally adopted for the bulb is about 1 millimetre, and this thickness in conjunction with a specially shaped bulb, successfully withstands a pressure of 650 lb/sq in (equivalent to a depth of about 1,300ft). By ensuring that the lamp is only operated when fully submerged, advantage can be taken of the cooling effect of the water, which enables the bulb size to be reduced and the resistance to implosion to be improved.

The connections to the lamp are protected by a moulded-rubber sealing muff which, with the special lightweight fitting originally designed by the A.R.L., was adapted by the G.E.C. to provide a complete underwater lighting unit. These units were used operationally for the first time during the search for the Comet aircraft which crashed in 1954, and recently, during trials undertaken by the diving ship H.M.S. *Reclaim*, the lamp was used in conjunction with an observation chamber at a depth of 1,000ft and there were no lamp failures.

The tests have proved that, in addition to its uses for underwater television, it can also be used in an observation chamber while directing the operations of a salvage grab. A diver can handle about four of the new lamps comfortably during underwater inspection work.

NEW ELECTRICAL EQUIPMENT

Flexible Terminal Block

A new 12-way, 25 A flexible terminal block manufactured from a "nylon" insulating material is available from METWAY ELECTRICAL INDUSTRIES, LTD., Metway Works, Canning Street, Brighton, 7, for an almost unlimited range of applications.

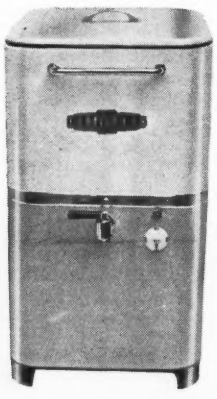
The voltage rating is 250 V, to earth, and 400 V between terminals. Fixing holes are provided between each pair of terminals and sub-division with a knife is possible as the material does not splinter when cut. The price of this "Exaktway" terminal block, list No. DK.12/25, is 10s 8d.

Wash Boiler

A new wash boiler, claimed to be a marked improvement on existing designs, has been introduced by EASICLENE PORCELAIN-ENAMEL (1938), LTD., Darlaston, Wednesbury, Staffs. Its vitreous enamelled tub has a capacity of 8 gal and a 3 kW immersion heater is situated in the base. The cover plate, also vitreous enamelled, is specially designed to give a jet action to the water when boiling clothes.

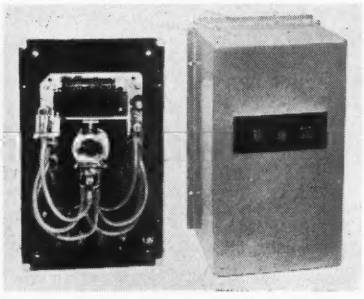
A red warning light, fitted above the 3-heat control switch, indicates when the heater is on. A chromium plated steel towel rail is mounted on the front panel as well as the drain tap of the tub which can be completely emptied without tilting.

The wash boiler is mounted on castors for ease of movement and measures 28in high by 16in square. There is a choice of white, cream or eau-de-nil finishes for the tub and lid and, below the waistband, the finish is white, cream, eau-de-nil, pale blue or red, in stoved enamel. The price, in any colour, is £15 15s.



Easiclene wash boiler

Baggs mercury switch contactor

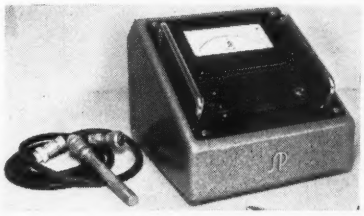


Mercury Switch Contactors

The latest product to be introduced by JOHN BAGGS & CO., Uppermill, near Oldham, Lancs., is a 75 A, 240 V, single-pole mercury switch contactor suitable for heavy duty. It measures only 10in by 6in by 5in, is silent in operation and consumes only 16 VA. Double, triple and multi-pole types are also made. Silicone insulation and impregnated coils permit operation at temperatures up to 90 deg C and in tropical conditions. Special low friction bearings are provided and the mechanical and electrical life is many millions of operations. Every contactor is subjected to a 20,000 operation test before dispatch.

Resistance Thermometers

The remote reading resistance thermometers available from SAVAGE & PARSONS, LTD., Watford, Herts., have an overall accuracy of ±1 deg C, according to the meter employed, and a sensitivity of ±0·1 deg C, thus allowing wide ranges of temperature variations to be shown accurately on the 4½in uniform scale of the meters. A choice of four models is at present available, covering a range of temperature variations of −50 deg C to zero; zero to 50 deg C; 50 deg C to 100 deg C; or 100 deg C to 150 deg C.



Savage & Parsons remote reading resistance thermometer

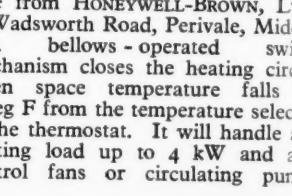
The sensing elements, which can be used at a distance from the instrument, are available in flat form for attachment to the surfaces and for interleaving, or alternatively, in the conventional immersion form.

The thermometer, with its heavy duty battery, forms a completely self-contained unit housed within a casing, and accurate thermometer readings are obtained throughout the 400 hours' life of the battery. A strong, compact case encloses the unit, which weighs 12 lb and measures 12in by 11½in by 9½in.

Room Thermostat

An easily installed (standard conduit box) wall mounting room thermostat suitable for controlling all forms of electrical heating to maintain a room temperature within the ranges 55-84 deg F or 42-75 deg F is now obtainable from HONEYWELL-BROWN, LTD., 1, Wadsworth Road, Perivale, Middx.

A bellows-operated switch mechanism closes the heating circuit when space temperature falls by 1 deg F from the temperature selected at the thermostat. It will handle any heating load up to 4 kW and also control fans or circulating pumps driven by motors up to 1 h.p. Finish is in black and gold and the price is £3 16s.



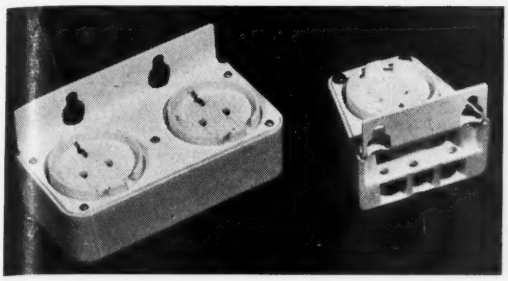
Honeywell-Brown room thermostat

Bi-Pin Fluorescent Tubes

Despite the many advantages of bi-pin caps it has until now been standard practice for fluorescent tube manufacturers to use bayonet caps for the 5ft and 8ft sizes. A recent announcement from THORN ELECTRICAL INDUSTRIES, LTD., 105-109, Judd Street, London, W.C.1, states that they are now adopting the bi-pin cap as standard on all "Atlas" tubes and that although the existing types of fittings will remain unchanged all "Atlas" fittings in future will be designed to take bi-pin tubes.

Among the many reasons leading to this decision is that the shorter cap and lampholder save space, enabling fittings to be shortened in length and placed in closer proximity end-to-end, thus reducing the extent of the dark gaps in a continuous run of light. The newly-patented bi-pin lampholder itself is robustly made and incorporates a heavily loaded spring that maintains the firm grip and positive contact essential for reliable operation. It is also thought that the use of bi-pin caps will do much to extend the popularity of the 8ft tubes.

By concentrating production re-



Twin and single "Atlas" spring-loaded bi-pin lampholders

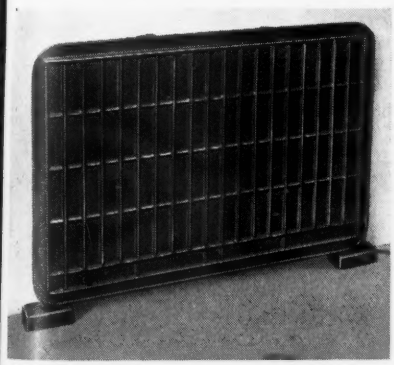
sources on the one more efficient type of cap and lampholder, fittings design will be facilitated and stocking simplified. For replacement purposes bayonet capped tubes will still be supplied and in addition an inexpensive adaptor will be available so that bi-pin tubes may be used in any existing fittings.

Low Temperature Heater

The standardised unit construction of a low temperature heater introduced by WARMEX, LTD., 375, Milton Road, Cambridge, permits close assembly to cover practically any area. The permanently encased long life element (1 kW) ensures maximum safety, a large indicator lamp showing when the unit is switched on.

The heater, which can be operated from a normal power point, is easily portable, weighing only 23 lb, and contains no oil or other liquid. Provision is made for floor or wall mounting or the heater can be suspended from a picture rail. An attractive stove enamelled bronze hammer finish has been adopted.

Provided with 6ft of flexible, wall



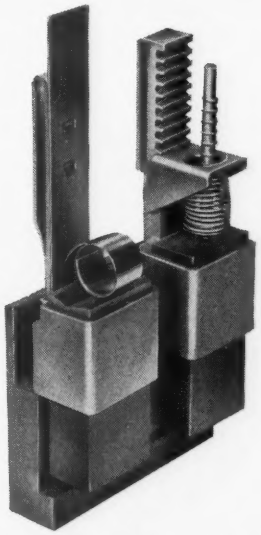
Warmex low temperature heater

brackets, hooks and fixing screws, the unit costs £8 5s 6d plus £2 14s purchase tax in the United Kingdom. Adjustable room thermostats are available as an extra.

Constant Tension Spring

A circular pre-stressed spring which gives constant tension for extensions ranging from zero to over 100ft is now available to suit a wide variety of individual requirements from TENSATOR, LTD., Acton Lane, London, N.W.10. These springs are capable of being formed for positive and negative load gradients and may be designed as extension members on torque producing motors.

Perhaps the most important electrical application of this product is as a commutator brush spring, and it is already being widely used in the



Tensator brush spring compared with conventional arrangement

United States for this purpose. With the development of these constant force or zero gradient springs, optimum pressure can now be obtained throughout brush life. Consisting of a coil of specially formed spring material, the Tensator spring exerts a constant restraining force to resist uncoiling, and it is capable of undergoing very large linear deflections with negligible build-up of the restraining force. Thus, full force is effectively maintained through the return stroke.

The use of these constant force springs also permits the selection of that contact pressure which will provide and maintain the minimum rate of combined mechanical and electrical wear without intermediate adjustments.

Dielectric Test Set

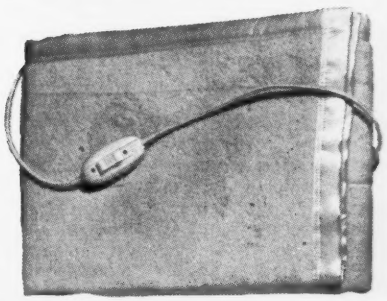
With the dielectric test set made by MICROCELL, LTD., Imperial Buildings, 56, Kingsway, London, W.C.2, direct readings can be made of permittivity and loss tangent for small samples at fixed spot frequencies, three different models being available to cover the frequency range 6,000 Mc/s to 17,000 Mc/s. Provision is made for dielectric measurements to be undertaken at temperatures up to 450 deg C. The equipment is designed for use by chemists having little knowledge of microwave techniques.

Electric Blanket

The Electrical Appliance Division of PHILIPS ELECTRICAL, LTD., Century House, Shaftesbury Avenue, London, W.C.2, announces the introduction of an electrically heated blanket the design of which, it is claimed, makes for complete safety in use. A grid wire circuit, so designed that no two sections of the wire can come into contact, passes a very low current through the blanket, carrying gentle heat all over it. The heating wire is covered with a plastic material and tests have shown that it will withstand considerably more strain and bending than is likely to be encountered in normal use.

The inner lining consists of a double layer of strong cotton material, woven into a series of pockets, and this is treated with a fireproofing process known as "Proban." The outer peach coloured cover is of soft fleecy blanket material and is fire resistant.

Of single bed size, 25 by 53in, it is suitable for operation on 230/240 V, and the loading is 56 W. An orange neon indicator lamp built into the on/off switch glows when the blanket is switched on. The price is £7 1s 5d plus £1 11s 1d purchase tax in the United Kingdom.



Philips electric blanket

Microcell dielectric test set

Financial Section

REPORTS and DIVIDENDS

British Insulated Callender's Cables, Ltd.—An interim dividend of 4 per cent on the £15 million ordinary capital has been declared (against 4 per cent on £12·35 million last year). In making the announcement, the company has issued an interim report in which it states that the turnover for the first half of 1956 totalled £68 million, as compared with £59 million representing half the figure for the full year, 1955. The group profit was, however, lower at £3,983,000 (against £4,813,000), and after providing £1,980,000 for taxation, the net balance was £2,003,000 (against £2,393,000). Strictly comparable figures are not available for the half-year to 30th June, 1955, but to permit of some comparison being made, one-half of the figures for the full year 1955 have been used. The interim report states that the group trading position in the second half of 1956 is on average being maintained at a satisfactory level, but due to present disturbed conditions and the increasing difficulty of passing on higher costs, it is anticipated that while satisfactory results will be achieved for the full year they will not reach the record level of 1955.

Contactor Switchgear, Ltd.—The annual meeting was held on 12th December, Mr. H. Rayner (chairman) presiding. In his circulated statement, the chairman said that the extensions mentioned in last year's report were now virtually completed, and the considerable amount of work entailed in moving into the new factory was well under way, and was being carried out without any serious effect on the output. These extensions now covered all their land at Wolverhampton and, in order to cope with increasing output, a plot of ground of 5½ acres had recently been purchased at Leominster, where it was intended to supplement the activity of the main works. The order book was in a healthy state. They had been forced to increase prices although these increases by no means covered the increased costs of labour and material.

Radio Rentals, Ltd.—The accounts for the year to 31st August last show a group profit of £1,028,586, as compared with £802,286 for the preceding year. Taxation absorbs £458,423 and the net balance is £570,163 (against £533,045), of which £569,053 is attributable to the parent company. It is proposed to pay a final dividend of 17½ per cent on ordinary capital doubled by a free scrip issue, making with the 10 per cent interim dividend on the smaller capital 27½ per cent for the year. For the previous year the total distribution was 40 per cent, of which the interim dividend was paid on £374,063, and the final dividend on £449,063.

Dewhurst & Partner, Ltd.—In his circulated review of the company's activities during the past year, Mr. M. Dewhurst (chairman and managing director) says that steady progress has been maintained in all fields of automatic electric control and has outstripped lift control, in which the company has always taken particular interest. The order book is now at a very high level in spite of increased output, and it is anticipated that this will be sustained throughout the coming year, particularly as a fair proportion of the orders involved are on long-term contracts.

R. A. Lister & Co., Ltd.—The preliminary figures for the year to 30th September last show that after providing £551,536 for taxation, the net profit for the year is £482,727, as compared with £471,278 for the preceding year. It is proposed to pay a final ordinary dividend of 7½ per cent, maintaining the distribution for the year at 10 per cent.

The Palestine Electric Corporation, Ltd., reports a net profit for the 15 months' period to 31st March last of I.£292,816, as compared with I.£96,723 for the year 1954. Taxation charges are I.£1,350,000. No ordinary dividend is proposed for the year.

George Kent, Ltd., have declared an interim dividend of 3 per cent (unchanged).

New Companies

Circuitest, Ltd.—Registered 15th November. Capital £5,000. To acquire the business of electric circuit testing carried on by D. L. Davies and M. Blair, etc. Directors: D. L. Davies and M. Blair. Solicitor: D. C. Sealy-Jones, LL.M., 130, Northfield Avenue, London, W.13.

Cossor Radio & Television, Ltd.—Registered 28th November. Capital £100. Manufacturers of and dealers in radio and television transmitting and receiving sets, etc. Regd. office: Cossor House, Highbury Grove, N.5.

Spin Dryer Co., Ltd.—Registered 10th December. Capital £1,000. General, mechanical and electrical engineers, etc. Directors: P. B. Courtney and N. Baker. Regd. office: 228, Harrow Road, W.2.

Soundwell (Radio & Television) Co., Ltd.—Registered 30th November. Capital £300. To acquire the business of a radio and television trader and engineer carried on by Flt. Lt. P. I. W. Trotter at Salford, 5, as Soundwell and Co. Directors: P. I. W. Trotter and E. P. Stopford. Regd. office: 465, Eccles New Road, Salford, 5.

Stanley Barron, Ltd.—Registered 30th November. Capital £100. Manufacturers of and dealers in radio, television and telephone apparatus, etc. Directors: S. G. Barron and Mrs. Kathleen M. Barron. Regd. office: 113, High Street, Rayleigh, Essex.

F. Ryman Electrical, Ltd.—Registered 30th November. Capital £1,000. To acquire the business of electrical engineers carried on at Hockley, Birmingham, as "F. Ryman," etc. Directors: W. F. Smith and H. J. Smith. Regd. office: 72, Hunters Vale, Hockley, Birmingham.

Leworthy's, Ltd.—Registered 4th December. Capital £5,000. Radio and television dealers and manufacturers, etc. Directors: L. P. Leworthy and Dorothy H. Leworthy. Regd. office: 407, Hither Green Lane, Lewisham, S.E.13.

T. A. Bradley & Son, Ltd.—Registered 4th December. Capital £1,000. Electrical engineers and contractors, etc. Directors: T. A. Bradley, Mrs. Helen I. M. Bradley and N. T. Bradley. Regd. office: 15/17, Wellington Road, St. Mary Cray, Kent.

Fluoralite Signs, Ltd.—Registered 3rd December. Capital £100. Manufacturers of and dealers in neon letters and other electric signs and signs of all kinds, etc. Regd. office: 98, South End, Croydon, Surrey.

F. Roden & Co., Ltd.—Registered 28th November. Capital £1,000. Manufacturers of and dealers in radio and television sets, etc. Directors: Doris M. Stallard and Constance M. Kershaw. Regd. office: 64, Darlington Street, Wolverhampton.

Neon & Fluorescent Sale & Rental Co., Ltd.—Registered 13th November. Capital £100. Electricians, electrical and mechanical engineers, radio, sign and television engineers, etc. Directors: S. C. Hazell, M. Moser and L. Platman. Regd. office: 30, Thayer Street, London, W.1.

Harry Sim & Sons, Ltd.—Registered in Edinburgh 2nd November. Capital £10,000. Electricians, electrical engineers, and contractors, producers of electrical energy, etc. Directors: H. Sim, Mrs. A. Sim, W. E. Sim and I. W. Sim. Regd. office: 81, John Street, Aberdeen.

Saint Albans Drawing Office, Ltd.—Registered 9th November. Capital £1,000. Designers, drawers, manufacturers and assemblers of electronic, radio, radar, acoustic, television and other instruments, etc. Directors: A. G. Balster and Mrs. Florence M. Balster. Regd. office: Abbey Mill, Abbey Mill Lane, St. Albans.

Shortlands (Hale), Ltd.—Registered 7th November. Capital £100. Retailers, wholesalers and servicers of electrical, radio and television equipment and appliances, etc. Directors: I. M. MacLennan and W. D. Radforth. Regd. office: 166, Ashley Road, Hale, Ches.

H. R. Jowett, formerly carrying on business with another as J. & L. Domestic Supplies Co., of 60, Church Road, Upper Norwood, London, S.E.19, as electrical appliance retailers.—Public examination 31st January at the County Court, Scarbrook Road, Croydon.

Bankruptcies

A. Le'N. Williamson, Sandringham Hotel, Hope Road, Shanklin, I. of W., hotel proprietor and electrical engineer.—Trustee, Mr. R. G. B. Booth, 21, The Avenue, Southampton, appointed 5th December.

A. J. L. Fleming, 54, Fore Street, Buckfastleigh, Devon, electrical engineer.—First and final dividend of 19s 2½d in the £, payable at 24, Lockyer Street, Plymouth.

D. E. J. Daniels, Horsham Court, Martley, Worcs, lately carrying on business at 27, New Street, Worcester, under the name of Douglas Electrical Repair Co., as an electrical engineer.—Receiving order made 5th December on debtor's own petition. Public examination 5th February at the Shire Hall, Worcester.

S. R. Nightingale, 149, Elm Bank Terrace, South Street, Andover, Hants, electrical engineer and poultry farmer, lately carrying on business at St. Swithin's, Waltham Chase, Southampton.—Last day for receiving proofs for dividend 29th December. Trustee, Mr. W. H. Meredith, 16, Westwood Road, Southampton, Official Receiver.

Liquidation

Britton Electronic Co., Ltd.—Winding up. Liquidator, Mr. F. Goodman, 77, Portland Place, London, W.1, appointed 28th November.

STOCKS and SHARES

BUSINESS in the Stock Exchange has continued to proceed warily, with an eye open to the possibility of further disturbance. Nevertheless the recovery established during the first half of this month was substantial enough to encourage the belief that markets would reach the Christmas holiday in a much more seasonable frame of mind than had previously seemed probable. In the gilt-edged market, conditions became a good deal happier after the Chancellor had exhibited the strength of the second-line reserves available for the support of the pound. This helped to put stiffening into the industrial market. Electrical engineering shares led the recovery movement, influenced by the announcement of the new atomic power station contracts. In the first fortnight of December, A.E.I. had advanced from 59s to 66s 3d, G.E.C. from 41s 9d to 48s, English Electric from 44s to 46s 3d, C. A. Parsons from 87s to 102s 6d, and A. Reyrolle from 93s 3d to the same figure. Dealings in the issues of new ordinary shares by the last two companies were expected to have begun by to-day (Friday).

Nuclear Power

While investment activity in connection with nuclear power developments has centred more obviously on shares of the principal electrical equipment companies concerned, there has been strong and persistent interest in the engineering firms grouped with them. Buyers have indeed been prepared to accept lower yields from shares in this category than they obtain from several of the leading electrical issues. Babcock & Wilcox ordinary at 73s, for instance, show a yield of 4·1 per cent, against the return of over 5¼ per cent from the shares of English Electric, with whom Babcocks are associated in the nuclear field. On Simon-Carves 5s shares at 27s the yield is 3·1 per cent, while on the connected G.E.C. shares it exceeds 5¾ per cent, assuming the maintenance of the dividend on the recently increased capital. In the case of A.E.I. £1 shares and John Thompson 5s shares at 31s 9d, the respective returns are about 4½ and 4 per cent. The £1 shares of Head Wrightson, associated with the C. A. Parsons group, have been quoted recently around 116s 3d, offering 3½ per cent on the basis of the last dividend. A similar return is shown by Clarke Chapman £1 shares at 126s 3d.

Crompton Parkinson

The 5s ordinary of Crompton Parkinson came well into the picture on news of the formation of the Atomic Power Construction Company. The quotation was advanced initially to 14s 6d, as compared with 13s a fortnight earlier. On the basis of the last dividend of 16 per cent, this made the yield 5½ per cent. Shares of other companies in the new group also reacted well. Richardsons Westgarth 5s ordinary were called 16s, at which level they offer a return of 5¾ per cent on the 16¾ per cent dividend. In the case of International Combustion 5s shares the price moved up to 20s, bringing the yield on the 20 per cent dividend to a round 5 per cent.

Cable Shares

An interim report from British Insulated Callender's Cables tells the increasingly familiar story of an increase in turnover accompanied by some reduction in profits over the first half of the current year. Results for the whole year are expected to be satisfactory, it is stated, although below the record figures of 1955 because of disturbed conditions and higher costs. B.I.C.C. shares, recently a little over 50s, have been holding their ground relatively well and, on the whole, the group of shares in cable manufacturing companies has been putting up fair resistance to the general trend of recent months. Share prices have admittedly lost a good deal of ground, but have lately been lifted clear of the low points recorded last month.

Current Yields

Yields on shares in the cable manufacturing group cover a wide range. The yield of 5¼ per cent on B.I.C.C. £1 ordinary is in line with that from the highest-grade industrials. On London Electric Wire £1 shares the return is also under 6 per cent. On Telegraph Construction £1 and Reliance-Clifton 5s shares the return from the latest dividends is between 6½ and 6¾ per cent. On Scottish Cable 5s and W. T. Henley's 10s shares the yields are respectively a little below and above 7 per cent. The return is about 8½ per cent on Aberdare Cables 5s ordinary, and over 10 per cent on Johnson & Phillips £1 shares, the current year's interim dividend on the latter having been lately reduced.

"Hollerith" Results

The £1 shares of British Tabulating Machine, producers of "Hollerith" equipment, were initially little changed, at around 41s, after the announcement of the final dividend and results for the year ended in September. Trading profits are shown to have continued well on the upgrade, improving by the best part of £100,000. A much heavier tax charge leaves the net surplus lower than before, at just over the half million mark, but this still gives better than threefold cover for the net amount of the dividends paid. These total 9 per cent for the year, as before, a reduction of 1 per cent in the final rate cancelling the earlier increase in the interim. This final payment does not go to the 800,000 new shares issued in July, which will rank for future payments. At the time of the issue the directors felt reasonably confident that profits over the next year or two would permit the maintenance of the present rate of dividend on the increased capital.

Stock on Offer

Several recent issues can still be bought without the expense of the 2 per cent transfer stamp duty. They include the 6 per cent unsecured loan stocks of G.E.C. and Ruston & Hornsby, currently on offer at about 101 in each case. The G.E.C. stock is £50 per cent paid up, with an equal instalment due by 11th January. In the lists of preference shares on offer, the new Watford Electric 6 per cent 10s shares have been shown at 9s 1½d to yield rather more than 6½ per cent. Others available recently in reasonably large numbers included A.E.I. 4½ per cent preference at 15s, and Power Securities participating preference at 26s 6d, both yielding around 6 per cent. London Electric Wire 7½ per cents at 24s 9d and Reliance-Clifton 5 per cent preference at 16s 6d, pay a fraction more on the money, and there is a return of over 6½ per cent from E.M.I. 5½ per cents at 16s 6d.

Convertible Loans

It is thought likely that a good deal more will be seen of capital offers in the form of convertible loan stocks such as the recent Morphy-Richards issue and the £40 million I.C.I. offer planned for the early part of next year. The latter is to combine a high-grade fixed-interest security, yielding a useful 5¾ per cent, with options to exchange, between 1958 and 1960, into ordinary shares at prices equivalent to a few shillings above the recent market quotation of 38s. To a large extent, holders of stocks in this form could feel protected against adversity, and assured of a good yield, if matters went ill for industrial investment. At the same time they will be in a position to share in the advantages of the ordinary shares, should conditions turn in their favour, and of the increased earnings expected to result from the employment of the new capital. This is evidently the sort of holding calculated to make a strong appeal in to-day's perplexing circumstances.

Owing to press arrangements for the Christmas period the usual "Electrical Investments" table has had to be omitted; it will appear again on 4th January.

Electric Dairy Vehicle Manufacture

Works for the production of their own electrically propelled delivery vehicles have been opened by Brampton Dairies, Ltd., of Northampton. The prototype vehicle was designed by Mr. H. F. Smith, the company's joint managing director and president this year of the National Dairymen's Association.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 0d each including postage) will be obtainable after 28th December from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1952

14315. Standard Telephones & Cables, Ltd.—Railway route setting equipment. 6th June, 1952. (764525.)

24842. General Electric Co.—Extended range phase comparators. 3rd October, 1952. (764473.)

32847. Brennan, J. B.—Electrolytic devices. 29th December, 1952. (764586.)

1953

6734. Electroflo Meters Co., Ltd., and Engel, F. V. A. E.—Fluid-flow measuring or control apparatus of the force-balanced type. 4th June, 1954. (764476.)

14371. General Electric Co., Ltd., Rudge, T. R., and Taylor, K.—Electrical measuring instruments of the repulsion moving iron type. 20th August, 1954. (764477.)

18334/5. Compagnie des Machines Bull.—Electronic computers. 2nd July, 1953. (764522/3.)

21552. Minister of Supply.—Electrical computing devices. 21st July, 1954. (764478.)

26755. Metropolitan-Vickers Electrical Co., Ltd.—Electronic sweep generating circuits. 15th September, 1954. (764590.)

28794. Compagnie des Machines Bull.—Electronic calculators or computers. 19th October, 1953. (764524.)

35064. Edison Swan Electric Co., Ltd.—Manufacture of germanium semi-conductor elements. 11th November, 1954. (764532.)

1954

1244. English Electric Co., Ltd.—Speed-responsive electric switch actuating mechanisms. 7th April, 1955. (764534.)

2950. Metropolitan-Vickers Electrical Co., Ltd.—Treatment of materials by electronic bombardment. 26th November, 1954. (764337.)

3411. Blomberger Holzindustrie B. Hausmann Ges.—Plywood heating plate for heavy electrical loads and a process for the manufacture thereof. 5th February, 1954. (764535.)

8645. Siemens & Halske Akt.-Ges.—Semi-conductor arrangement comprising a cathode, an anode and a control electrode. 24th March, 1954. (764489.)

8804. Bird Electronic Corporation.—Apparatus for measuring high frequency energy in a coaxial transmission line. 25th March, 1954. (764597.)

11371. Philips Electrical Industries, Ltd.—Welding devices, preferably for use in touch welding. 20th April, 1954. (764598.)

13111. Pole, J. C.—Electric light fittings. 5th May, 1954. (764541.)

20405. Kuettner, C., and Bruns, E.—Electric ovens. 13th July, 1954. (764545.)

24509. Patent Management, Inc.—Variable electrical inductances. 23rd August, 1954. (764614.)

27679. General Electric Co.—Automatic temperature control systems. 24th September, 1954. (764341.)

1955

66. Northrop Aircraft, Inc.—Electrically actuated step-by-step mechanism. 3rd January, 1955. (764344.)

125. Air Reduction Co., Inc.—Braking systems for a.c. motors. 3rd January, 1955. (764511.)

174. Electrolux Corporation.—Adjustable control devices for automatic vacuum cleaners. 4th January, 1955. (764512.)

245. General Electric Co.—Control arrangement for reversing electric motors. 4th January, 1955. (764399.)

1117. Kabelschlepp Ges.—Means for supporting flexible members such as electric cables, flexible pipes, flexible shafts and conveyors. 13th January, 1955. (764349.)

1497. Felt & Tarrant Manufacturing Co.—Transducer apparatus. 18th January, 1955. (764352.)

1628. General Motors Corporation.—Control system for an electric heater element. 19th January, 1955. (764426.)

1659. General Electric Co.—Capacitors. 19th January, 1955. (764427.)

1720. Standard Telephones & Cables, Ltd.—Radio broadcast receivers. 20th January, 1955. (764428.)

1818. Siemens & Halske Akt.-Ges.—Single sideband television transmission systems. 20th January, 1955. (764440.)

1966. Pinet, A. E.—Device for the distribution of electrical pulses. 21st January, 1955. (764447.)

2033. Hamilton Watch Co.—Battery operated electro-magnetic wrist watch. 24th January, 1955. (764450.)

2521. General Electric Co.—Dial or panel lighting. 27th January, 1955. (764464.)

3243. Sangamo Weston, Ltd.—Remote indicating apparatus for meters. 3rd February, 1955. (764638.)

3364. Standard Telephones & Cables, Ltd.—Tuning indication for intercarrier television receivers. 4th February, 1955. (764360.)

3590. General Motors Corporation.—Electromotive traction control system. 7th February, 1955. (764367.)

3738. Siemens & Halske Akt.-Ges.—Devices for recording telegraphic impulses. 8th February, 1955. (764371.)

3662. Bosch Ges., R.—Electric accumulators. 8th February, 1955. (764556.)

3896. General Electric Co.—Electric transformer wound cores. 9th February, 1955. (764374.)

3980/1. Allmanna Svenska Elektriska Aktiebolaget. — Air-blast electric circuit-breakers. 10th February, 1955. (764646/7.)

4160. Crompton Parkinson, Ltd.—Fittings for fluorescent electric lighting tubes. 11th February, 1955. (Addition to 746053.) (764653.)

4199. Antiference, Ltd., and Best, N. M.—Plug for coaxial electric cables. 11th February, 1955. (764654.)

4203. Suddeutsche Kabelwerke Zweig-Niederlassung der Vereinigte Deutsche Metallwerke Akt.-Ges.—Electric cables. 11th February, 1955. (764657.)

4265/6. General Motors Corporation.—Welded laminated stator assemblies. 14th February, 1955. (764567/8.) 4267. Dynamo-electric machine core members. 14th February, 1955. (764568.)

4437. Twitchell, Inc., E. W.—Electric cables of the expanded type. 15th February, 1955. (764572.)

4517. General Electric Co.—Stationary electrical induction apparatus. 15th February, 1955. (764576.)

4745. Ateliers Hanset.—Television test pattern generators. 17th February, 1955. (764667.)

4931. Standard Telephones & Cables, Ltd.—Electric wave-guide filters. 18th February, 1955. (764669.)

5115. International Business Machines Corporation.—D.c. generator circuits. 21st February, 1955. (764672.)

5465. Siemens Soc. per Azioni.—Devices for facilitating the starting of electrically-driven compressors. 23rd February, 1955. (764379.)

5726. Centre National de la Recherche Scientifique.—Electrostatic machines. 25th February, 1955. (Addition to 655474.) (764382.)

5730/1. Hazeltine Corporation.—Transistor reactance device. 25th February, 1955. (764383/4.)

5925. Moulon, J. M.—Class B transistor amplifiers. 28th February, 1955. (764390.)

TRADE MARK APPLICATIONS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 28th December:—

ROWEN. No. 755,266. Class 7. Domestic washing machines and parts.—Rubery Owen & Co., Ltd., Victoria Works, Booth Street, Darlaston, Staffs.

DEBONAIR. No. 755,993. Class 7. Machines for washing, drying and ironing, all for laundering purposes. DEBONAIR. No. 755,994. Class 11. Electric heating apparatus. CREDA CAPRI. No. 756,648. Class 11. Heating apparatus and installations and parts.—Simplex Electric Co., Ltd., Broadwell, Oldbury, Birmingham.

ROLLELECTRIC. No. 757,561. Class 8. Electric shaving instruments and parts.—Rolls Razor Ltd., 255-289, Cricklewood Broadway, London, N.W.2.

PAINTON. No. B743,069. Class 9. Electric switches, terminals, potentiometers, resistors, radio frequency chokes, plugs and sockets therefor and radio attenuators and faders; and dials and pointers, all being indicating components for use with electrical and electronic apparatus.—Painton & Co., Ltd., Bembridge Drive, Kingsthorpe, Northampton.

SFIM (design). No. B748,144. Class 9. Measuring and signalling apparatus and instruments; and electric and electronic apparatus for controlling the operation of aircraft and guided missiles, and for use in the remote control of aircraft, watercraft and land vehicles.—Société de Fabrication d'Instruments de Mésure (S.F.I.M.), Paris, France. Address for service, c/o Pollak, Mercer & Tench, 134, Cheapside, London, E.C.2.

REDITUNE. No. B754,978. Class 9. Radio and television receiving apparatus and parts.—Central Rediffusion Services, Ltd., Carlton House, Lower Regent Street, London, S.W.1.

EMPRESS. No. 755,544. Class 9. Electric vacuum cleaning apparatus.—Bylock Electric, Ltd., 109, South Street, Enfield, Middx.

PRESINT. No. 755,606. Class 9. Parts of electric, electronic, radio and scientific apparatus and instruments.—Morgan Refractories, Ltd., Liverpool Road, Neston, Wirral, Ches.

TEE-F TEE-F (design). No. B756,304. Class 9. Insulated electric wire and electric cables.—Wandleside Cable Works, Ltd., 106, Garratt Lane, Wandsworth, London, S.W.18.

CINETRA (design). No. 756,662. Class 9. Electrical apparatus and instruments, scientific apparatus and instruments; and photographic and cinematographic apparatus.—Cinetra Manufacturing Co., Ltd., 12, Oval Road, Camden Town, London, N.W.1.

No. 757,235 (design). Class 9. Electrical apparatus and instruments and parts.—J. H. Humphreys & Sons, Ltd., Blackriding Electrical Works, Werneth, Oldham.

PYE PIPER. No. 757,323. Class 9. Radio and television receiving apparatus and parts.—Pye, Ltd., Radio Works, St. Andrews Road, Cambridge.

HI-MAX. No. 757,512. Class 9. Television aerials and parts.—Telerection, Ltd., Antenna Works, St. Pauls, Cheltenham, Glos.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia.—Snowy Mountains Hydro-Electric Authority. 5th February. 330 kW transportable standard voltage transformer. (E.S.B. 30787/56. Ten/23133.)* 12th February. Lightning arrestors and surge counters for 330 kV system. (E.S.B. 30616/56. Ten/23098.)* 19th February. Air blast circuit-breakers and air cored reactors. (E.S.B. 30788/56. Ten/23132.)*

Bath.—City Council. 12th January. Cables, lamps, lanterns, control gear, time switches, etc., for street lighting for the year ending 31st March, 1958. E. Dixon, town clerk, Guildhall.

Belgian Congo.—Ministry of Colonies, Brussels. 7th January. 126 electric cookers. (E.S.B. 30703/56. Ten/23176.)*

Burgess Hill (Sussex).—U.D.C. 4th January. Convector-type electric heaters for 64 dwellings in Woodland Avenue and Eastdale Road.

Canada.—Saskatchewan Power Corporation. 7th January. 138 kV switchgear and control equipment. (E.S.B. 30224/56. Ten/23119.)*

Durham.—County Council. 2nd January. Electrical installations in eleven schools. (See this issue.)

Greece.—Agricultural Bank of Greece, Athens. 10th January. Automatic telephone switchboard. (E.S.B. 30693/56. Ten/23123.)*

India.—Government of Madras, Electricity Department. 27th December. 24 electrically driven pumping sets. (E.S.B. 31224/56. Ten/23209.)* 7th January. Equipment for Neyveli 33/110 kV substation. (E.S.B. 30683/56. Ten/23107.)*

Director General of Supplies and Disposals. 11th January. Tool room tempering equipment and electric arc furnace. (E.S.B. 31034/56. Ten/23191.)* 24th January. Four electrically operated pumping sets. (E.S.B. 30751/56. Ten/23114.)*

Iraq.—Directorate General of Post and Telegraph. 7th January. Telephone wiring equipment. (E.S.B. 31013/56. Ten/23171.)*

Directorate General of Municipalities. 12th January. Two 100 kW alternator sets. (E.S.B. 31011/56. Ten/23170.)*

New Zealand.—Auckland Electric Power Board. 18th January. L.v. cable. (E.S.B. 30849 and 30848/56. Ten/23156-7.)*

Wellington City Corporation Electricity Department. 12th February. Underground cable. (E.S.B. 30836/56. Ten/23177.)*

Northern Ireland.—Ministry of Finance. 28th December. Electric lamps for government establishments during the year ending 31st January. The Ministry (Room 103), Law Courts Building, May Street, Belfast.

Pakistan.—Director General, Posts and Telegraphs. 2nd January. Copper wire and accessories. (E.S.B. 30973/56. Ten/23160.)*

Persia.—U.S. Operations Mission to Iran. 5th January. Four 17,000 lb/hr steam boilers and parts. (E.S.B. 30966/56.I.C.A. Ten/23166.)*

Philippines.—National Waterworks and Sewerage Authority. 17th January. Two electrically driven deep well turbine pumping sets. (E.S.B. 31056/56. Ten/23174.)*

Selby.—U.D.C. 21st January. Street lighting equipment. (See this issue.)

South Africa.—Union Tender and Supplies Board. 27th December. Three power switchboards for Port Elizabeth airport. (E.S.B. 31259/56. Ten/23212.)* 10th January. 50 automatic voltage regulators. (E.S.B. 30752/56. Ten/23112.)* 17th January. Nine automatic starting diesel alternator sets ranging from 9-35 kVA. (E.S.B. 30754/56. Ten/23109.)*

City of Durban Corporation. 11th January. Five six-panel e.h.v. switchboards. (E.S.B. 30850/56. Ten/23159.)*

Stores Department, South African Railways. 11th January. Electrical outdoor distribution wire. (E.S.B. 30808/56. Ten/23145.)* Cable and copper wire. (E.S.B. 30807/56. Ten/23146.)* 16th January. Overhead track equipment. (E.S.B. 30809/56. Ten/23147.)*

Sudan.—Ministry of Communications. 29th December. Underground and submarine cables. (E.S.B. 30745/56. Ten/23120.)*

Equatoria Projects Board, Nzara. 30th December. 565 kVA diesel generating plant. (E.S.B. 31184/56. Ten/23207.)*

United States.—Little Rock District Corps of Engineers. 10th January. Equipment for the Table Rock dam powerhouse including control switchboards, console control assembly, generator equipment and invertor motor generator equipment, etc. (E.S.B. 30917/56. Ten/23179.)*

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

ORDERS PLACED

Isle of Ely.—County Council Education Committee. Electrical installation work at Littleport New Secondary School (£5,260).—J. A. Brown & Partners.

Leeds.—City Council. Recommended. Electrical installations in 102 dwellings on the Brackenwood estate (£2,475).—B.C.S. Electrics. Electrical installations in 92 dwellings on the Belle Isle estate (£2,429).—Hall & Stinson. Electrical installations in 132 dwellings on the Belle Isle and Stonegate Farm estates (£3,022), and 148 dwellings on the Belle Isle and Beechwood estates (£3,509).—Vallance & Davison.

Shipley.—Housing Committee. Installation of power points in 106 houses (£1,195).—Brown Bros. (Electrical).

Warrington. — Welfare Services Committee. Electrical installation work in the main block at the Whitecross Homes (£1,033).—H. Bibby & Co.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Ashtead.—Additional buildings for City of London Freemen's School; Franklin & Andrews, surveyors, 173, Fleet Street, London, E.C.4.

Atherstone.—Houses (200) on site adjacent to Atherstone North estate; clerk to R.D.C., 102, Long Street, Atherstone, Warwicks.

Basingstoke.—Houses (56), Grubb Lane, East Oakley; R.D.C. surveyor, Eastlands, London Road.

Berwick.—Houses (100); John H. Pierce, Osborne Road, Tweedmouth, Berwick.

Birkenhead.—Pork factory, Marshall Street, etc.; Birkenhead and District Co-operative Society, Ltd., 14, Catherine Street.

Birmingham.—Eight-storey block of luxury flats in Melville Road, Edgbaston (£400,000); A. G. Sheppard Fidler, city architect, Civic Centre, 1.

Blyth.—Houses (52) in Phœnix Street; D. W. Foster, borough engineer.

Bradford.—Rhodesway Secondary School; Scherrer & Hicks, architects, 19, Cavendish Square, London, W.1.

Brighton.—Flats (480), Dinapore Street area; borough engineer.

Cambridge.—Central Grammar School for Boys; Gilbert Ash, Ltd., builders, 2, Stanhope Gate, London, W.1.

Chester-le-Street.—Houses (200) at North Lodge; William Leech, Ltd., builders, Clayton Street, Newcastle-on-Tyne.

Chichester.—Scheme for technical college, county college, secondary modern and secondary technical schools, on the Westgate Fields site; F. R. Steele, West Sussex county architect, County Hall, Chichester.

Christchurch (Hants).—Somerford County Infants' School; Hants county architect, The Castle, Winchester.

Colchester.—Flats (8) and houses (16), Eight Ash Green; Duncan Clark & Beckett, architects, 7, West Stockwell Street.

Coventry.—New hostel at The Butts (£51,500), for the Y.W.C.A.; C. Redgrave, architect, The Quadrant, Warwick Road, Coventry.

Cowplain.—Houses (1,000) on new estate; A. G. Figgins, Ltd., Little Park estate, Bedhampton.

Cumberland.—School at Dalston; county architect, 15, Portland Square, Carlisle.

Darlington.—R.C. school in Harris Street; T. A. Crawford, architect, 80, Borough Road, Middlesbrough.

Durham.—Proposed new schools at Barnard Castle, Dunston Hill, Middleton-St.-George, Sedgefield and Sherburn; county architect, South Street, Durham.

Ealing.—First phase of scheme for extensions to Town Hall (£65,000); C. W. Seddon, borough surveyor, Town Hall, London, W.5.

Easington. — Houses (269); Peterlee Development Corporation.

Edinburgh.—Shops, maisonnettes, flats, at Saughton Mains Gardens (£55,000); A. Steele, city architect.

Felling-on-Tyne.—Three infants' schools; county architect, South Street, Durham.

Gateshead.—Houses (76) at South Saltwell; Tarran & Co., Ltd., Dorran Works, Perth.

Grimsby.—Hospital, Scarthoe Road, to replace three existing hospitals (£3,500,000); Grimsby Hospital Management Committee, Grimsby.

Guildford.—Development at Royal Grammar School; J. Harrison, Surrey county architect, County Hall, Kingston-on-Thames.

Havant.—Library at Park Way; county architect, The Castle, Winchester.

Hertfordshire.—Girls' secondary modern schools at Bishop's Stortford (£183,203) and Boreham Wood (£205,622); C. H. Aslin, county architect, County Hall, Hertford.

High Wycombe.—Houses (100), as development of the Castlefield Hostel site; J. A. Parkinson, borough surveyor, Municipal Offices, Queen Victoria Street.

Hindley.—Cardinal Newman R.C. Secondary School (£150,088); G. Noel Hill, county architect, County Offices, Fishergate Hill, Preston.

Ipswich.—Flats (64), Wells Street; borough surveyor, 19, Tower Street.

Kingston-on-Thames.—Block of shops and offices in Clarence Street, for Ravenseft Properties, Ltd.; L. H. Fewster & Partners, architects, 22, Conduit Street, London, W.1.

Leeds.—First stage of new arts building at the University; Lanchester & Lodge, architects, 10, Woburn Square, London, W.C.1.

Leicester.—Shops and maisonnettes (15), Thornby Lodge estate; H. Snowden & Co., Ltd., 127, Tudor Road.

Leyton.—Houses (42), Dyson Road; D. J. Osborne, town clerk, Town Hall, London, E.10.

Lichfield.—Houses and flats (131), Wheel Lane estate; D. Oglesby, city engineer, Guildhall.

Linton.—County school; William Airey & Son (Leeds), Ltd., Eldon House, Leeds, 2.

London.—Flats (63), Aldersbrook estate, Wanstead; W. C. Cearns, Ltd., Carpenters Road, E.15.

Blocks of buildings to include offices, warehouses, refrigerated store, restaurant, etc., Southwark; M. C. Hughes & Partners, architects, 119, Victoria Street, London, S.W.1.

National Film Theatre, Waterloo Bridge, Lambeth; L.C.C. Architects' Department, County Hall, S.E.1.

Factory, Cavell Street, Stepney; Ellis & Goldstein, Ltd., 20, Commercial Street, E.1.

Factory in Barchester Street, Poplar; architectural department, Co-operative Wholesale Society, Ltd., 99, Leman Street, E.1.

Longbenton.—Church (£30,000); J. & G. Lowery, Corporation Street, Newcastle.

Loughborough.—New general works, engineering offices and welfare block for Genatosan, Ltd.; Handisyde & Taylor, architects, 68, Great Russell Street, London, W.C.1.

Manchester.—Conversions at junior art school forming a central clinic, with medical annexe, Byrom Street; city architect, P.O. Box 488, Town Hall.

Factory and offices, Floats Road, Wythenshawe; A. C. Scott & Co., Ltd., 39, City Road.

Neath.—Laboratories for National Oil Refineries, Ltd., Llandarcy; Staverton Builders, Ltd., Staverton Bridge Mills, Totnes.

Newcastle-on-Tyne.—Presbyterian church, Wyndham Avenue; Tasker & Child, architects, 25, New Bridge Street.

Factory additions, Benfield Road, for Tizer, Ltd., The Rock, Bury; own architects.

Newport (I.O.W.).—Houses (109), Bellecroft site, and houses (66), Pan estate; F. Rath, borough engineer, 39, Quay Street.

Nottingham.—Administrative buildings for Public Health Department, Shakespeare/Dryden Streets area; R. M. Finch, city engineer, Guildhall.

Nuneaton.—Dwellings (113), Sorrell Road and Coton Road; borough surveyor.

Oldham.—Houses (850), proposed as development of Fitton Hill extension; borough surveyor, 75, Union Street.

Oxford.—Extensions to the pharmacology buildings for the University; Gollins, Melvin, Ward & Partners, architects, 15, Manchester Square, London, W.1.

Penge.—Girls' secondary school; S. H. Loweth, Kent county architect, Springfield, Maidstone.

Peterborough.—Shops and maisonnettes on the Walton estate, and houses on the Gunthorpe estate; city architect, Bridge Street.

Peterlee.—Houses (269) at Acre Rigg for Peterlee Development Corporation, Shotton Hall, Castle Eden; chief architect.

Plymouth.—Dwellings (58), Southway; city architect.

Preston.—Infants' school, Gamull Lane, Ribbleton; Wilfrid C. Mangan, architect, 2, Ribblesdale Place.

Purley.—Houses (100), Old Lodge estate; Joseph Cartwright, Ltd., 9, Streatham High Road, London, S.W.16.

Flats (27); Wood & Weir, surveyors, 5, Wigmore Street, London, W.1.

South Mimms.—St. Giles' C. of E. School; Claridge & Hall Bros., Ltd., builders, 2a, Station Road, Harpenden.

South Shields.—Houses (97) at Whiteleas (£133,000); borough engineer.

Stockton-on-Tees.—Three-storey flats and maisonnettes (45) in the Garbutt Street area; borough architect, 28, The Square.

Stowmarket.—Flats (40), Chilton Hall estate; clerk, Council Offices, Ipswich Road.

Stretford.—Departmental stores, 12-18, King Street; F. W. Woolworth & Co., Ltd., 1, New Bond Street, London, W.1; E. Woodhouse, company architect.

Factory, Elevator Road; Key Engineering Co., Ltd., Trafford Park, Manchester.

Sunderland.—Houses (136), on the Hylton Red House estate for the T.C.; L. W. Evans, Ltd., contractors, 18, Norfolk Street.

Houses (48) at Dunelm South for R. L. S. Pemberton; G. T. Brown and Son, architects, 53, Fawcett Street.

Health centre for Hylton Castle and Red House estates (£30,000); borough architect, Grange House, Stockton Road.

Sutton Coldfield.—Works, Reddicap trading estate; Chambers of Sutton, Ltd., South Parade.

Swindon.—First stage of new general hospital; W. E. Chivers & Sons, Ltd., builders, Devizes.

Tynemouth.—Three-storey offices, Nile Street; Britannic Assurance Co., Ltd., Broad Street Corner, Birmingham, 1.

Wednesbury.—Experimental three-storey flats, Russell Street corner site; borough surveyor, Town Hall, Holyhead Road.

Wells.—Secondary modern school; R. O. Harris, county architect, Park Street, Taunton.

Whitehaven.—Houses (48) for the T.C.; John Laing and Sons, builders, Dalston Road, Carlisle.

Worcester.—Houses (259) on Warndon estate; city engineer, 22, Bridge Street.

Wrexham.—Dwellings (139), Holt Road and Offa Terrace; borough surveyor.

Street Lighting Improvements

ST. MARYLEBONE Borough Council has decided, as a matter of urgency, to carry on with its street lighting programme for the year as originally planned. North of Marylebone Road the main streets will have sodium lighting while to the south the lighting will be fluorescent. An amendment that the whole borough should have fluorescent lighting was defeated.

BRADFORD Corporation's provisional programme for 1957-58 provides for the extension of sodium lighting throughout the main bus routes at a cost of £45,000.

CLITHEROE Corporation is applying for permission to borrow £10,800 for the second phase of the town's street lighting conversion scheme.

HASTINGS Highways and Works Committee has approved in principle schemes estimated to cost approximately £12,500 for improvements to main road lighting.

EXMOUTH Roads and Works Committee has received loan sanction enabling the Council to proceed with its new lighting scheme through the main town thoroughfares. There will be fluorescent lighting through the town centre.

YEOVIL Corporation is seeking sanction to borrow £24,545 for street lighting.

Fluorescent lighting is being installed in the principal streets of WOKING at a cost of £24,000.

DOVER Corporation is to bring the lighting of Marine Parade up to modern standards at a cost of £2,900.

WORKSOP Corporation has approved schemes to cost £10,099 for the provision of street lighting in Cheapside, Bridge Street, Bridge Place and in Gateford Road.

HINCKLEY (Leics.) U.D.C. is to convert further gas street lamps to electricity at a cost of £6,265.

TYNEMOUTH Town Council has approved in principle a £21,000 scheme for converting the town's street lighting from gas to sodium electric discharge. For some years the Council has also been converting filament electric lighting on certain main roads to sodium lighting. When the change-over has been completed, the operating costs will be about £1,400 per annum less than with the existing system.

BASINGSTOKE Corporation is applying for permission to borrow £12,408 for street lighting schemes in Winchester Road, Hackwood Road, Essex Road, Brook Street, Junction Road and on Station Hill.

HOUGHTON-LE-SPRING U.D.C. has received £3,525 loan sanction for improving electric street lighting.

THETFORD Council is to submit for Ministry approval a scheme, estimated to cost £2,325, for the extension of street lighting on the London-Norwich trunk road.

FELLING (Co. Durham) U.D.C. has received loan sanction for £3,677 for improving the electric street lighting in Windy Nook Road, Coldwell Street and Carr Hill Road, Felling.

YORK Streets and Buildings Committee is to improve the street lighting from Micklegate Bar to The Chase Hotel, Tadcaster Road, at an estimated cost of £5,400.

BOLDON (Co. Durham) U.D.C. is in touch with the Ministry of Transport regarding the proposed installation of new lighting along the trunk road.

SCARBOROUGH Town Council has received loan sanction for £8,004 for the provision of electric street lighting on the North Marine Road, the Spa Bridge and part of Filey Road, in place of the present gas lighting.

PETERLEE (Co. Durham) Council has approved a £12,000 scheme for street lighting at Effington Way and Yhoden Road.

STAMFORD (Lincs.) Town Council is to convert further gas street lamps to electricity.

CHESTERFIELD Town Council is to install sodium lighting along the main Brimington road inside the borough boundary.

WALLSEND Town Council is considering converting street lighting on main bus routes from gas to electricity, and the North Eastern Electricity Board has been asked to submit an estimate of the cost.